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## ORIGINAL ARTICLES

# MEDICAL DIAGNOSIS IN RELATION TO SURGERY.[1]

By David Riesman, M.D.,

PROFESSOR OF CLINICAL MEDICINE IN THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA.

The domain of surgery has been so widened in our own time that there is scarcely a medical condition that may not in some of its phases become a surgical one. By the very vastness of his field has the surgeon been forced to specialize and to devote himself exclusively to the eye, the ear, the nose and throat, the genito-urinary tract, or the female genital organs. The advantages of such a distributive process are many—and are too well known to be reiterated here. But there are some incidental disadvantages. At first sight these might seem to have nothing to do with my present theme. There is, however, a very logical connection. We find that the laity no longer consult their family physician for their well-defined regional complaints — they go directly to the ophthalmologist, otologist, laryngologist, etc., who if he finds an operative condition proceeds in the majority of cases to deal with it surgically. Not all will deem it necessary or important to have a medical examination made, a neglect that may jeopardize the patient's life.

Medical diagnosis to my mind involves not only the recognition of the existence of a surgical condition but also a careful study of the patient as a surgical risk. No surgical operation requiring anes-

[1] Paper read before the College of Physicians of Philadelphia as part of a symposium on The Relation of Medicine and Surgery. The paper also formed the basis of an address before the Springfield Academy of Medicine, Springfield, Mass.

thesia should be done without the approval of a medical man, based upon a thorough examination of the patient. Such an examination involves a study of the heart, the blood pressure, the temperature, the lungs, the kidneys, the blood, and the psychic and nervous systems. The results of his findings, in so far as they may affect the operation and its before- and after-treatment, the physician should communicate to the surgeon and together they should weigh the patient's status. But while I hold that no operation should be done without study of the case by a competent medical man, I also believe that no surgeon should ever operate solely on a medical man's opinion. He should on his own account study the case from the broadest aspect and arrive at an independent judgment. If the two men cannot agree, than a colleague of proper standing should be called as an arbiter. Cases will, of course, arise in which a determined surgeon, in sole charge of a patient, will operate with the whole faculty against him, or in which the medical man, having the patient's life primarily in his keeping, will refuse to consent to an operation that all the surgeons hold imperative. Such cases, however, do not alter the fact that the *modus operandi* I have sketched is, both for the patient and for the fair name of medicine, most desirable.

Coming now to the specific topic I have chosen, I am overwhelmed with the immensity of the subject of the medical diagnosis of conditions surgical. It appears to me of some advantage to have a working classification and to give to this a regional basis. A further advantage is obtainable by lopping off all consideration of things that are obvious. There are a number of conditions the surgical treatment of which does not admit of a difference of opinion—such as strangulated hernia, division of a large blood-vessel, fractures, dislocations, impaction of foreign bodies in the air passages—these need not detain us. Yet it might not be amiss to point out one or two possible errors in diagnosis. Thus I once saw a woman supposed to be suffering from neuritis of the brachial plexus in whom I discovered a dislocation of the humerus. And further, in a study of cervical rib made several years ago, I found that this condition may lead to the diagnosis of aneurysm of the subclavian artery and of neuritis. A correct diagnosis would render possible a cure by surgical means.

Beginning with the head, medical diagnosis concerns itself with such surgical and quasi-surgical conditions as fracture, tumor, abscess, and meningitis. In many respects the first is the most important, inasmuch as where alcoholism co-exists the fracture may be overlooked. Not a few young internes have made this grievous mistake and have perhaps sacrificed life, and incidentally brought discredit upon themselves and their hospital. I have always taught that no obviously alcoholic patient should be sent from the hospital if he presented one of two conditions—a very

rapid or an unnaturally slow pulse—the former might indicate a dangerous weakness of the circulation, the latter cerebral compression.

The medical diagnosis of tumor need not be discussed in detail. There is but one point I desire to emphasize, viz., that uremia may in every way simulate tumor of the brain and without the guiding hand of a clinician, a useless and probably fatal operation may be done.

Abscess of the brain most often springs from middle ear disease. As the history is not always definite and as the patient is not rarely seen in a stuporous state, the ears and mastoid processes should always be examined in every obscure "head case." A history of chronic ear trouble and intense uncontrollable headache should arouse suspicion of abscess.

Meningitis of the suppurative type is, thanks to Irving Haines, now being claimed, somewhat furtively as yet, by the surgeon as his domain. Hence the medical man must be prepared to diagnose it as early as possible. Intense headache, rigidity of the neck, Kernig's sign, the character of the spinal fluid after lumbar puncture, are the signs and symptoms leading to a correct diagnosis.

In the neck the principal disease to interest us is exophthalmic goiter. No disease is more easily recognized and yet he who does not see it at once may remain blind to it despite its obviousness until someone else points it out. The medical man is called upon to diagnose the disease, the cardinal symptoms of which are too well known to need mentioning here, and at the same time to determine whether the patient is in an operative state—assuming that an operation is contemplated. He will advise against immediate operation if the patient is highly thyrotoxic—has pronounced tachycardia, enlarged heart, slight fever, gastric symptoms, and psychic exaltation.

In the case of lymphatic enlargements in the neck, the physician has to determine whether they are tuberculous, leukemic, or due to Hodgkin's disease. A blood examination will reveal the second, but is of little help in differentiating between the other two. The hard character of the enlargement and the presence of glandular masses elsewhere is in favor of Hodgkin's disease. It should also be remembered that spinal symptoms are sometimes an early manifestation both of Hodgkin's disease and of leukemia.

A word might be said about the status lymphaticus. If it can be proven that death in this condition is due to compression of the trachea by the enlarged thymus, then the medical man should know how to diagnose it speedily so that the surgeon may be called in time. The age of the patient, cyanosis, inspiratory dyspnea, dullness over the manubrium, and perhaps a laryngeal examination are aids to prompt diagnosis.

In the chest the diagnostic problems of surgical conditions are

few and not very troublesome. Most important is empyema. As far as its diagnosis is concerned, it should always be thought of in children suffering from fever with marked sweating and anemia. It should furthermore be borne in mind that it may be a terminal condition in the aged, manifesting itself only by fever and slight dyspnea. Between these extremes, a diagnosis is rendered somewhat easier if a history of preceding pneumonia is obtainable. There are, however, rare instances in which empyema seems to be there from the beginning. It then simulates pneumonia very closely. If the empyema is interlobar, the symptoms will suggest the presence of pus but the physical signs may fail to reveal its location. Localized tenderness may sometimes act as the divining rod.

If the medical man has located the pus by means of the exploring needle, the surgeon in operating should make his incision at the same place, no matter whether the spot is best from a surgical point of view or not. I have seen a surgeon disregard, for the purpose of getting better drainage, the point of puncture, and fail to find the pus. Sometimes with very marked symptoms only a spoonful of pus is present, and this may be missed if the surgeon does not follow the point of original entry.

When empyema has been diagnosed in an adult and the history reveals no previous chest condition, the possibility that the pus may be below the diaphragm should be envisaged. Depression of the liver dullness, a patch of tympany, data suggesting the existence of an old gastric ulcer or appendicitis, together with a radiographic examination will usually determine a subphrenic abscess. Exploratory puncture should be made with a needle of large calibre. It will demonstrate the presence of offensive "colon" pus and perhaps gas.

Abscess and gangrene of the lung are rare—diagnosis is far less difficult than localization. The *x*-ray is very helpful but may mislead us as to depth and height. The other signs and symptoms hardly need discussing.

The surgical conditions involving the heart are chiefly two—mediastinopericarditis and pericardial effusion. The operation for the former—cardiolysis—is still on trial, so that the medical diagnosis does not greatly interest the surgeon. Pericardial effusion is usually overlooked, more often, I think, than any other disease. The operation for paracentesis is done as often by the medical man as by the surgeon, but when the fluid is purulent the latter should be called in to establish drainage. I need not dwell on the diagnosis except to say that pericardial effusion may be mistaken for pneumonia. I have seen one case that might have been saved had the proper diagnosis been made.

A curious diagnostic error in connection with disease of the heart has come to my notice two or three times and as it has a surgical

interest I will cite one case. A patient had a large tender epigastric swelling, vomiting, anorexia, and great prostration. The surgeon to whom he had been referred diagnosed a gastric carcinoma, and decided to operate, but before doing so wanted a medical opinion. This opinion was "mitral stenosis, loss of compensation, enlargement of the left lobe of the liver, and congestion of the stomach."

In the diagnosis of surgical conditions of the abdomen, it is of practical advantage to treat separately what English and American writers call the *acute abdomen*. Many acute conditions are not grave and demand medical treatment only, such as indigestion, ptomaine poisoning, so-called, and lead colic. But a careful examination and a good history are always necessary or mistakes will be made. Assuming that the case is one of considerable severity — then, having ruled out a dietetic error as the cause, the first question should be: Is the trouble really in the abdomen or is it in the chest? A few months ago I was asked to see a man who was about to be placed on the table to be operated upon for appendicitis. The expert anesthetist, upon making a cursory examination, had grown a little suspicious of the heart and had demurred taking the responsibility of administering ether without the support of a medical opinion. Study of the case forced me to the conclusion that the man had lobar pneumonia and not appendicitis. The diagnosis was confirmed by subsequent events. This is not the only experience of the kind that I have had but in none did operation hover so close. I am inclined to think that too much stress is laid upon vomiting. If the initial chill of pneumonia follows hard upon a heavy meal, whether the patient is an adult or a child, vomiting is likely to occur.

Not only appendicitis but gall-stone colic, acute pancreatitis, perforation of a gastric or duodenal ulcer, may be simulated by chest conditions. Hence, before definitively diagnosing any one of these, the chest must be carefully explored. The laity, ignorant of the tribulations of the doctor, would never forgive an error in diagnosis that entailed an abdominal operation for a chest condition, but we who know how one may mimic the other, should be sparing in our criticism.

In the diagnosis of other conditions causing the acute abdomen, the history is of incontestable value. The age of the patient, previous attacks of pain and leukocytosis, may determine the diagnosis of appendicitis. It is indeed a fair assumption that acute inflammatory conditions of the abdomen during adolescence are of appendiceal origin, quite regardless of the area of greatest pain. I say quite regardless of the area of the greatest pain advisedly; the greatest *tenderness* is usually found on the right side.

In women the most important acute abdominal conditions to bear in mind, aside from appendicitis, are ruptured extra-uterine

pregnancy and torsion of an ovarian cyst. The former is not difficult of diagnosis. The history may help but does not always do so—pallor, sighing inspiration, abdominal dulness, and vaginal examination establish the diagnosis. Torsion of an ovarian cyst I have met four times. In none of the cases had there been any previous knowledge of the existence of the cyst or of any pelvic trouble whatever. Illustrative of the importance of medical diagnosis I may say that in the first case a diagnosis of uremia had been made by the attending physician on account of uncontrolable vomiting, there having been no other definite abdominal symptoms.

Acute conditions of the abdomen also rouse the suspicion of rupture of an ulcer of the stomach or of the duodenum. As prompt recognition is of the greatest importance, I will dwell for a moment on the diagnostic features of rupture in duodenal ulcer, as that is a fairly common happening.

Perforation of the ulcer is usually an extremely sudden process. It causes at once intense pain and collapse which may be followed in a little while by a temporary lull in the symptoms. This lull, which is probably caused by the non-irritant character of the duodenal contents, is very deceptive and may lead to errors in diagnosis. The pain is usually in the epigastrium but may be in the appendix region; the abdomen, until near the agonic period, is of board-like hardness. In the final diagnosis the history is of the greatest importance: a history of periods of disturbed digestion with pain (hunger pain), especially nocturnal, alternating with periods of good health. The male sex, as is now well known, predominates in duodenal ulcer.

Empyema of the gall-bladder may set in with acute or "stormy" symptoms, to use a Teutonic idiom, and may be diagnosed as ruptured gastric ulcer. The diagnostic points upon which I would lay stress are the history of previous attacks of colicky pain, good health in the intervals, tenderness in the gall-bladder region, and fever. Sometimes the gall-bladder can be felt if very light pressure with the warmed hand is made.

Another acute condition requiring a skilled medical diagnosis is acute pancreatitis. The symptoms of that are not characteristic. They may be interpreted as ruptured ulcer or empyema of the gall-bladder or intestinal obstruction. Perhaps the most valuable guide to correct diagnosis is to have pancreatitis in one's *arrière pensée*. Many difficult conditions, as Charcot remarked long ago, are happily diagnosed by merely thinking of them. If there is a history of gall-stones, the diagnosis of pancreatitis, if otherwise justified, is greatly strengthened.

A rather peculiar diagnostic difficulty came under my notice last year. A surgeon asked me to see an old lady suffering from intense pain in the right upper quadrant of the abdomen. It was doubtful whether the trouble was in the gall-bladder or in the

right kidney. Careful examination showed an erythema following the intercostal nerves and extending over the right upper abdomen. There were no vesicles but it seemed so much like herpes zoster that I ventured that diagnosis. Within a day or two the well-known vesiculation appeared. Dr. Lawrence Litchfield, of Pittsburg, has recently reported several similar cases.

I have not exhausted the acute abdominal diseases, but time does not permit me to include all of them. A word, however, about perforation in typhoid fever. Few conditions impose such a heavy responsibility upon the doctor. If he could be sure, his course would be easy, but the diagnosis is not as simple as some writers claim. A sudden pain, slight leukocytosis, rise in the pulse rate and of the temperature, and disappearance of the liver dulness are nearly sufficient for diagnosis and justify surgical intervention. All the symptoms, barring the last, may, however, be produced by suppuration of a mesenteric gland; but as this is also an operative condition, the possible confusion matters little.

Coming now to the consideration of more chronic conditions, we find one of the most difficult tasks to be the proper interpretation of the functional disturbances of digestion. Which are and which are not amenable to surgical treatment? Though the work of surgeons like the Mayos, Moynihan, Deaver, and Robson, has greatly clarified this subject, it still remains one of undoubted perplexity. The too enthusiastic abdominal surgeon, seeing some cases of dyspepsia and hyperchlorhydria associated with gastroduodenal ulceration, concludes that all such cases have a similar basis. I believe that hyperchlorhydria may be a purely functional condition. Even hunger pain and hyperchlorhydria are not infallible signs of duodenal ulcer. Yet, if the patient so suffering is a man and in every way a fit surgical risk, we are probably justified in advising an operation, on the assumption that the cause of his trouble is duodenal ulcer. The *x*-ray in skilful hands is of great diagnostic value, showing in these cases a hypermotility of the stomach with rapid propulsion of the bismuth meal into the duodenum. In every case of so-called gastric neurasthenia or nervous dyspepsia, characterized by bloating, eructation of gas, a variable appetite, and nervous depression, an organic basis should be suspected. Often it is gall-stones. A correct diagnosis is impossible without a careful history and a thorough physical examination, particularly search for Mayo Robson's tender point. We must not be misled by left-sided pain, for just as appendicitis may sometimes cause pain on the opposite side, so may gall-stones, especially when there are adhesions between the gall-bladder and the stomach.

As a matter of medico-surgical interest, I should not omit to mention the fact that the gastric crises of locomotor ataxia may closely simulate gall-stone colic.

The subject of splanchnoptosis is one of great interest at this

time. Its relation to chronic ill health and to constipation makes correct diagnosis and proper treatment a pious desideratum. I have not been convinced that surgery is the only way to success and believe that the admirable work of Coffey, of Portland, Maine, has demonstrated that much can be accomplished by purely non-operative means.

Abdominal tumors present great diagnostic difficulties, and the most skilled clinician often goes astray. Those involving the stomach are perhaps the least perplexing. Gastric symptoms of short duration, loss of weight, signs of food retention, and sub-acidity suggest carcinoma. Confirmation may be obtained by an *x*-ray examination. The position of the tumor is not of great moment. It may be anywhere from the right rectus to the left flank, from the epigastrium to below the umbilicus. Every effort should be made to diagnose malignant disease before a tumor appears so that removal can be accomplished before other parts near and distant are inseminated.

There is a type of tumor in the abdomen that gives rise to unusual diagnostic pangs. It may be found in the region of the colonic flexures on the left side and on the right side anywhere from Poupart's ligament to the border of the ribs. At first examination such a tumor may impress one as malignant if the patient has reached the cancer age, or as tuberculous if he is younger. Careful examination will, however, show certain peculiar features—the growth is rapid, there is usually a spot of great tenderness; there may be a periodic or continuous fever; and the blood count shows a leukocytosis. These signs, indicate, I believe, that the tumor is inflammatory, no matter how smooth or nodular, how small or large the growth may be. The mimicry of disease is never greater than in the case of these inflammatory swellings which have their origin in the appendix or in a diverticulitis of the colon.

The diagnosis of appendicitis is commonly so easy that the veriest tyro in medicine can make it. Difficulties arise in chronic cases, where the symptoms are chiefly those of dyspepsia and in certain acute cases in which the appendix occupies an abnormal position. In every case of dyspepsia in early adult life, the physician before incriminating the stomach or the nervous system, as is so often done, should carefully palpate the region of the appendix. Soreness when the colon is inflated with air and pain referred to the epigastrium on pressure at McBurney's point have recently been acclaimed as diagnostic signs of chronic appendicitis.

Intestinal obstruction is an important field in which prompt medical diagnosis with the aid of the surgeon often saves life. I shall not take your time to rehearse the symptoms of the various types of obstructon. Some, like strangulated hernia, are easily recognized if one makes it a practice in all cases to examine the hernial openings whether a hernia is visible or not. I want to

speak about two points only, first, that acute pancreatitis may simulate ileus and, second, that kaleidoscopic uremia may present the picture of intestinal obstruction.

With regard to the spleen, the condition of chief surgical interest is splenomegalic anemia, splenogenous cirrhosis of the liver, or Banti's disease. Here it is the medical man's duty to establish a correct diagnosis, inasmuch as removal of the spleen is the approved and proper treatment. The diagnosis is based on enlargement of the spleen, on a history of hemorrhages from the nose or the stomach, on the presence of anemia with leukopenia and, in more advanced cases, on evidence of coexisting hepatic disease.

The surgical conditions involving the kidney give rise to pain in the loin and flank. If the trouble is inflammatory, whether intrarenal or extrarenal, there will be tenderness in the costo-iliac space. From the surgeon's standpoint the conditions demanding particularly accurate diagnosis are perirenal abscess and unilateral nephritis.[2] A microscopic and bacterioscopic examination of the urine will assist in the diagnosis. It should be borne in mind, as I have already mentioned, that herpes zoster may in its pre-eruptive state simulate these renal conditions.

One other condition needs mentioning here on account of the diagnostic problems it brings in its train, and that is Pott's disease. Pott's disease is never too old to cause trouble. For some unknown reason, the tubercle bacilli in the sheltered region of the spine seem to live forever. If an abscess forms it will travel downward and may then cause symptoms of great perplexity, intercostal neuralgia and thoracic aneurysm being some of the diagnoses I have seen made.

In the case of the extremities, the surgical conditions coming under the physician's ken are few. I have mentioned dislocation simulating neuritis. Perhaps the most important is osteomyelitis, which when near a joint is likely to be mistaken for articular rheumatism. In a child, persistent pain at or near one joint is almost never rheumatic in origin. Furthermore, it should be remembered that what may seem to be abscesses along the course of the bones may in young infants be blood extravasations the result of scurvy. A proper diagnosis by the medical man, based on a careful history of the case, may prevent a useless and hurtful operation.

An interesting condition of growing importance is thromboangeitis. This may be erroneously treated as rheumatism by the medical man, and, as in one case I have seen, as flat-foot by the surgeon.

I have not exhausted the surgical conditions which it may

[2] See paper by Riesman and Müller, "Acute Unilateral Nephritis, with Report of a Case," Archives of Internal Medicine, June, 1913.

become the medical man's duty to diagnose. I have tried to focus your attention upon those more difficult ones, borderland cases they might be called, in which keen medical diagnosis is necessary for the proper coöperation with the surgeon, a coöperation he should not only be glad to accept, but eager to seek.

I would emphasize once more the value of a medical examination, not only in obscure but also in plain, simple surgical cases. The physician might find diabetes, nephritis, grave anemia, bronchitis, or serious heart disease, anyone of which would influence the surgeon in his work. Many delayed deaths after operation might thus be averted. I also feel that in medical cases which may at any time assume a surgical aspect, the surgeon should be consulted long before an operation becomes imperative.

In order to increase his diagnostic skill, the physician should make it a rule to be present at all operations on cases that have come before him. Sir Berkeley Moynihan in England and Deaver in this country have found it necessary to remind us physicians of the value of the *autopsia in vivo*.

In closing, permit me to say that in all spheres of life, the best work is team work, and the best team for the cure of human ills is the great medical triumvirate—the laboratory man, the surgeon, and the sane, level-headed physician.

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## THE ASSOCIATION OF UTERINE GROWTHS WITH GOITRE; TYPICAL AND ATYPICAL EXOPHTHALMIC GOITRE.

By Henry L. Elsner, M.D.,

PROFESSOR OF MEDICINE, SYRACUSE UNIVERSITY, SYRACUSE, NEW YORK.

Let those who believe that medicine has made no progress during the last thirty years, remember that during that time we have learned all that we know today concerning the physiology and pathology of the ductless glands. No chapter in medicine is more important, none more promising, none has added more to human happiness, for it includes the introduction of organic extracts into medicine. But three decades have passed since Brücke announced to the medical world that "so far as the function of the thyroid is concerned, we have absolutely no hypothesis to offer." At the same time, Wittiche made the statement that "we know less of the functions of the thyroid and adrenals than of the spleen and thymus gland, and that we know almost nothing of the latter." Since that day the association of animal experimentation, clinical observation, pathological research, and therapeusis have developed knowledge, supplying data which are leading

both the physician and surgeon to conclusions which in practice prove rational and life-saving.

The dawn is breaking and we are beginning to understand more clearly than ever before the far-reaching influences of the internal secretions and their reciprocal relations, including their effect on the growth and functions of individual organs. The importance of these revelations the profession fully appreciates.

The relations of the thyroids and genitals have been recognized by the profession and lay world during all the ages. The change in the size of the thyroid after defloration led many tribes to measure the organ with a thread to decide upon the chastity of the bride, because of its increase after initial coitus. Catull's Epigram is based upon the demonstration:

"Non illam gentrix orienti luce revisens
Hesterno poterit collum circumdare filo."

Gothe's Epigram so fully quoted by Freund is based upon the same physiologic observation:

"Ach, mein Hals ist ein wenig
geschwollen, so sagte die Beste
Ängstlich . . . Stille, mein Kind,
still und vernehme das Wort.
Dich hat die Hand der Venus berührt,
sie duetet dir leise.
Dass sich das Korperchen bald, ach
unaufhaltsam verstellt."

Von Eiselberg's experiments prove the close relation of the thyroid and sexual organs; Bircher, Freund, Ullman, and others have fully corroborated his conclusions.

The behavior of the thyroid during puberty, menstruation, pregnancy, labor, and lactation argues in favor of its close relation to the uterus and its dependencies. Kocher has found after extensive thyroidectomy profuse metrorrhagia, and classifies this symptom as "metrorrhagia thyreopriva." He concludes that the quantitative reduction of the menses in such cases is a direct proof of improvement, and treats these cases with thyroidin. Lawson Tait recognized the relation of the thyroids to the uterus, for he held that all women with goitre showed a tendency to menorrhagia and uterine anomalies. There are cases in which during amenorrhea the thyroid gland enlarges, to retrograde with the established flow (Sloan, Ewald, Klokow).

Mendes de Leon, four weeks after myomectomy in one of his cases, described atrophy of the thyroid; the gland persisted, however and was still palpable several years later. Glaessner, in a case with multiple uterine myomas and fully developed Basedow's disease, observed marked improvement and retrogression during the climacteric. Fraenkel believes that he has succeeded in reducing

the size of the goitre in myomas treated with *x*-rays, and he believes that the improvement in these cases is due to the cessation of ovarian function. W. F. Freund's study of the literature of the subject proves that the older descriptions of Basedow's disease included symptoms of functional disturbances of the organs of generation in women, though the gynecological abnormalities were not fully described. He was the first to investigate their association more thoroughly than had been done before, and he reported that without exception he was able to demonstrate chronic atrophic parametritis in all of his cases of exophthalmic goitre. In 1899 Kleinwachter called attention anew to the frequency of menstrual anomalies and changes in the organs of generation with exophthalmic goitre, and included the corroborative evidence offered by Jenks, Foote, Pastroit, Porchet, and P. Müller. Amenorrhea was a frequent complication included in these clinical reports. Cheadle before Kleinwachter called attention to the atrophic changes of the genitalia with exophthalmic goitre. It has been noted that if the disease attacks girls before puberty they are likely to remain amenorrheic (Henoch and Hall, and Edwards). Improvement or cure has, as a rule, been followed by the establishing of normal menstruation.

Exophthalmic goitre developing during pregnancy is exceedingly rare; it has only occasionally happened that the complex was influenced by parturition; usually the symptoms persist. It may be concluded that these patients have, as a rule, been unfavorably influenced by pregnancy, and convalescence has been abnormally slow. In my series of cases patients with exophthalmic goitre, with or without uterine growths, have rarely conceived.

During pregnancy all symptoms are liable to be aggravated, particularly those referable to the nervous system.

So far as the influence of castration on the thyroid is concerned, it is impossible to conclude that exophthalmic goitre is either favorably or unfavorably influenced by such treatment. Mathieus reports a case in which exophthalmic goitre developed after the removal of the ovaries, while Blocq reports a case in which the disease was cured after double oöphorectomy.

The close relationship of exophthalmic goitre and sexual life is accented by the preponderance of the disease in women.

Buschan in 980 cases of exophthalmic goitre found 175 in men and 805 in women. Mannheim reports the proportion of men to women in his cases 1 to 8.2 per cent. The proportion in the cases which serve as the basis for this article is 1 to 9. Until we had our cases tabulated, the frequency of exophthalmic goitre in men had not impressed us forcibly.

The writer has made an analysis of 5370 cases of internal diseases, and found 186 cases, or 3.46 per cent. of goitre. Of this number, 89, or 1.66 per cent., were simple, uncomplicated goitre;

97, or 1.8 per cent.; were diagnosed as belonging to the class of exophthalmic goitre; of this number 55, or 1.2 per cent.; proved to be atypical exophthalmic goitre; 42, or 0.78 per cent. were typical in all symptoms of exophthalmic goitre; 15 per cent. of all the cases of goitre seen (186) included in 5370 cases of internal disease proved to be associated with uterine myoma or fibromyoma.

Since 1881 my clinical experiences have demonstrated the frequent association of thyroid perversion, often hyperthyroidea, including simple goitre and exophthalmic goitre, typical and atypical with uterine growths, fibroid and myomatous.

In 1879 a case of typical exophthalmic goitre came to my notice in which there was also a fibromyoma of the uterus, which latter gave rise to but few symptoms, and was accidentally discovered. In this case the severe Basedow's complex ran its course, uninfluenced by medicines in about two years. Every prominent symptom save the goitre disappeared. The myoma caused but little disturbance during many years, but after fifteen years, underwent cancerous degeneration, which killed the patient. There never was a return of a single symptom of exophthalmic goitre.

My early experiences with this and other cases led me to observe in all cases of goitre wherever possible the condition of the uterus. This study has justified me in teaching since 1881 what I have observed, that is, the unusual frequency of uterine growths with thyroid abnormalities, more particularly with the various forms of goitre, typical and atypical exophthalmic goitre.

In 1891 W. Freund called attention to the association of frequent thyroid change with uterine myoma. It was found that the enlargement of the thyroid was more pronounced, with growths containing a preponderance of connective tissue. This association is by no means accidental; there is a causal relation. The association of these lesions has remained practically unnoticed, and has almost entirely escaped the attention which it deserves. This is true because the internist, whose function it is to treat thyroid perversion, in the majority of his cases finds nothing in the history which leads to the uterus as a source of symptoms, while the gynecologist in his cases of uterine tumor, limits his investigation to the organs in which he is most interested, and either overlooks or fails to record in his histories the presence of goitre with associated symptoms. The subject is one of exceeding importance from a pathological and therapeutic point of view, and we present but a few histories in abstract to support our contentions.

The following history includes sensory symptoms, analgesia, thermo-anesthesia, the typical picture of syringomyelia, cystic ovary, uterine fibromyoma, goitre, acromegaly, granuloma, trophic changes, invasion of the sympathetic system, multiple cutaneous pigment deposits, fibroid growths, and urinary anomalies:

Mrs. X., Cortland, N. Y.; housewife; aged fifty-two years; weight, 242 pounds, normal weight, 150 pounds; five feet five and one-half inches in height; coffee and tea drinker; temperate; has two children, aged thirty-two and twenty-one years respectively. Consultation with Dr. Higgins. Seen on April 6, 1910. Family history shows father and mother both dead. Father was rheumatic; mother had neuritis. All members of the family are and have been decidedly rheumatic. One brother died of Bright's and heart disease. Patient had the usual diseases of childhood, otherwise well; never had an accident.

Twenty-one years before she had noticed a peculiar sensation, which she said was difficult to describe, in the index and middle finger of the right hand. At times this sensation was painful, extended into both arms, and finally both hands were more or less numb; there was occasionally cramping in the hands and arms.

Twelve years before the diagnosis of uterine fibroid was made; later it was found that she had a large ovarian cyst, with a fibroid uterus. Five years before the cyst, weighing 28 pounds, was removed, also the fibroid uterus. She menstruated but once after the operation. One year after the operation her right hand became analgesic and thermo-anesthetic. These sensory symptoms were less developed in the lower extremities. Soon there was the same loss to pain and to heat and cold in the left hand. She was forced to watch her fingers, because when near the stove, handling hot water or fire, she unconsciously burnt herself, and when using a knife would cut her fingers, which for several years had grown larger, with a persistence of the sensory symptoms. At the time of her first visit there was a large blister on the tip of her middle finger, resulting from a burn, of which she had no knowledge at the time of its receipt. At various times she had burned and cut almost all of her fingers.

Three years before the characteristic growth of acromegaly became noticeable. Her feet and hands seemed to run a race in their development with the small bones of her face, particularly her jaw and nose. All of her facial bones were enlarged; the upper jaw was retracted; the lower jaw was pushed forward, enormously thickened, and broadened. The teeth of the lower jaw were far in advance of the upper. There was characteristic broadening of the nose; prominence of the frontal bones, but moderate enlargement of the calvarium. The greater changes were in the small bones of the face, including the jaw, also in the hands and feet. The tongue seemed too large for the mouth. It was enormously thickened, broadened, and when protruded covered an unusually large area, and was three and one-half inches broad. Just back of the upper teeth, springing from the buccal mucosa, there was a large granuloma. Almost immediately after the operation a double goitre developed, larger on the right side than on the left, both

lobes presenting a prominence about the size of a grape-fruit. There was some scoliosis, with the characteristic hold of the head. There was a peculiar "catching," as she expressed it, of her fingers when she tried to close her hands, and as she released them a peculiar cracking sound was heard.

An error of refraction was corrected by glasses; the eye reflexes were normal; the patella tendon reflexes at the time of her first visit were absent; ankle-clonus was absent. The eyes seemed small because of the abnormal development of the orbit.

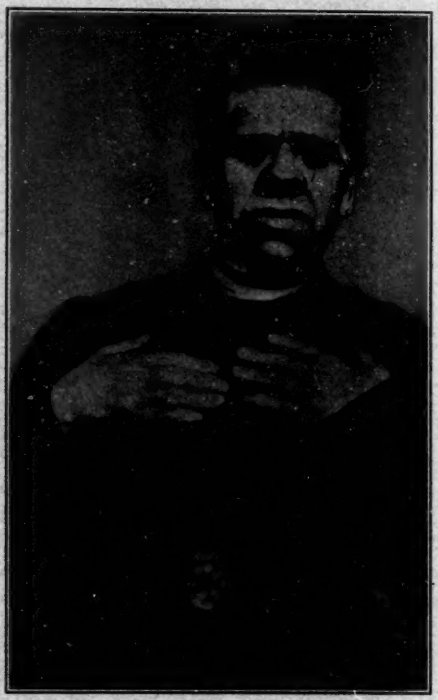
The urine analysis proved exceedingly interesting. Specific gravity, 1025; acid reaction; amber colored; peculiar, disagreeable odor; turbid deposit; faint trace of albumin by both tests; no sugar; urea, 1.6 per cent.; phosphates increased; no bile; chlorides normal; uric acid, 0.80 per mille; faint trace of indican. Under the microscope there was found abundant bacteria; pus cells in large numbers; large, squamous, epithelial cells; occasional red-blood corpuscles; few finely granular casts; some amorphous urates. Blood examination showed: hemoglobin, 80; red-blood cells, 4,000,000; white-blood cells, 8000; no pathological nor morphological change.

Perspiration was excessive and erratic. She was very much depressed; pulse, 88; respirations, 18; temperature, 98.2°; blood-pressure between 90 and 100 mm. Hg. (Systolic).

PHYSICAL EXAMINATION. Superficial examination of the body showed many pigment deposits; rough, dry skin; multiple, small fibromas. There was one fibroma directly under the skin which annoyed her exceedingly over the spine of the tenth or eleventh dorsal vertebra. There was a well-developed panniculus adiposus.

When seen on September 28 the cutaneous fibroid masses had grown. One on the back was pedunculated and we tied it. Heart was slightly dilated; there was no murmur; the arteries showed some thickening. There were no physical signs referable to any other organs. Her mental processes were quick; she was disheartened by her facial change and felt her condition keenly. At the time of her second visit, September 28, she thought she was somewhat better. This was due to the fact that she had lost weight and her face in consequence looked a little thinner. Her weight was 214 pounds. Her syringomyelic and acromegalic symptoms were unchanged. Her shoulders were painful. She was much less depressed than she was when first seen, and took a more hopeful view of her condition. Perspiration continued annoying. Her sensory symptoms remained limited to her hands and feet, analgesia and thermo-anesthesia. There never had been muscular atrophy. The rigidity, which had been noted by Raymond, Dejerine, and Redlich, seemed to be increasing. Her speech seemed gutteral because of the enormous space occupied by her enlarged tongue.

At the time of her last visit the left patella tendon reflex was feebly present, the right was absent. There was a faint ankle-clonus; her eye reflexes were all sluggish.



Case of associated acromegalia, syringomyelia, goitre, ovarian cyst, multiple subcutaneous fibromata, etc.

RECAPITULATION. The sequence of symptoms and pathological changes in this case are unique and interesting.

1. The peculiar sensations experienced over twenty-one years in her right hand marked the beginning of what later developed into a pure syringomyelia.

2. The development of uterine fibroid and the ovarian cyst progressed independently of the first-named condition.

3. The operation five years before, necessitated by the enormous size of the cyst, gave impetus to further developmental anomalies.

4. The prompt development of analgesia, thermo-anesthesia, and rigidity, all without atrophy of muscles, marked the beginning of the onward march of syringomyelia.

5. The prompt development of the goitre after her surgical operation was stimulated unquestionably by the removal of the organs of generation.

6. The rapid changes of acromegaly.

7. The development of the granuloma.

8. The prompt appearance of pigment deposits; excessive and erratic perspiration; multiple cutaneous and subcutaneous fibromas, *pari passu* with the goitre, and the development of acromegaly.

9. The invasion of the kidneys, probably in a limited parenchymatous nephritis, with an unusually high uric-acid content of the urine, while the urea was comparatively low. With these conditions there was a gradually increasing arteriosclerosis.

There were a number of interesting features in connection with the subject under consideration which deserve to be mentioned with a study of my material. Goitre is increasing, and so are thyroid perversions in all civilized countries, a fact to which Breitner has recently called attention. Probably we make more thorough search because of our increased knowledge, and detect the atypical cases which were formerly overlooked; but this fact is not alone responsible for the increasing frequency.

Whatever the complications which we consider associated with goitre, typical or atypical exophthalmic goitre, we are promptly convinced of two further facts:

1. One, surprisingly prominent, proves that the disease is often self-limited; spontaneous recovery is not at all uncommon.

2. The subjective and objective manifestations prove the protean character of many goitres.

There is a decided tendency to disregard atypical cases of exophthalmic goitre, and they often remain unrecognized. Cautious, clinical study proves the frequency of what Stern has called Basedowoid cases. These are atypical, but they include a sufficient number of typical symptoms to justify the diagnosis of thyroid perversion. There are a large number of cases associated with distant changes in which there are but one or two symptoms of thyroid disturbance. These cases justify the conclusion that much of the ill health of the patient is due to perverted secretion.

A study of thyroid disease emphasizes the fact that there are periods of latency during which there are practically no symptoms save a goitre, large or small. These periods are followed by exacerbations, including positive symptoms of hyperthyroidea, and in some marked changes in the arterial tree.

While writing this paper we were called to see a case in consultation with Dr. Osgood, at Jordan, a classic example of acute hyperthyroidism and uterine myoma, in a woman, aged sixty-four years, who for years had goitre without subjective symptoms. She was the mother of six children; family history showed some tuberculous taint; her confinements were all normal. Her previous

history showed that she had erysipelas many years before. Had always been a hard-working woman.

Last fall, after a period of stress, which included excessive worry, it was noticed that an insignificant goitre, to which she had given but little attention during the many years of its existence, was becoming tense, somewhat tender, and seemed to cause some obstruction. At once she became tired, excessively nervous, and had annoying and uncontrollable palpitation. She grew progressively worse; the symptoms were all more or less aggravated when lying on her left side. Three weeks before she was awakened during the night with alarming tachycardia and cardiac irregularity. She was much frightened, and said she was "unable to control herself." Dr. Osgood saw her at this time, and found her in a precarious condition; her pulse was so rapid that it could scracely be counted, with frequent intermissions and marked irregularity. The tachycardia ceased as suddenly as it commenced, but the heart continued irregular. Coincident with these explosive symptoms, followed by marked depression, the patient, who had never before experienced any abdominal inconvenience, complained of soreness and tenderness in the lower abdomen. Careful questioning proved that the goitre had increased in size during the previous eighteen months, and that the eyes had become more prominent than normal during the same period. She further volunteered the information that she felt "tired throughout her abdomen," and that during the eighteen months there had been considerable distress, to which she paid but little attention. She passed the menopause at fifty-five years without symptoms, and until the beginning of the increasing tenderness in the lower abdominal regions she had no knowledge of a pelvic abnormality. Her last child was born when she was forty-four years of age.

The leading features in this case, as expressed by the patient, were the painful abdominal conditions, marked tenderness, the symptoms referable to her heart, the goitre, tremor, excessive nervousness, and loss of weight, with marked Graefe and Moebius, the complex of symptoms of exophthalmic goitre.

When we saw her on April 20, 1913, the pulse was 130; systolic blood pressure, 170; diastolic, 100; pulse amplitude, 70; heart enlarged and dilated; systolic bruit heard over the entire precordium. Uterine examination showed the presence of an enlarged myomatous uterus, at least four times the normal size of the organ in a woman, aged sixty-four years.

We could reproduce this history a number of times with the rehearsal of cases equally typical, of suddenly developing thyroid perversion, with associated uterine growths, in patients who had gone to middle life and far beyond without subjective disturbances, in which the sudden onset of symptoms had entirely ungeared the patient.

We are fully convinced that whatever distant lesions were associated with thyroid enlargement, it may be positively assumed that in the presence of goitre, whatever the previous history may have been, symptoms may suddenly develop referable to such growth; some of these cases may lead to acute and serious cardiac insufficiency, in others to paroxysmal seizures, and in the third class of cases, to continuous symptoms of thyroid perversion.

We have previously referred to "perverted function" and "perversion." We think in the present state of our knowledge this is justified, for we are not yet possessed of knowledge which is positive in connection with thyroid abnormalities, and we need a "loop-hole" through which we may finally escape more gracefully and easier than if we were dogmatic in our statements and attributed all symptoms to hyperthyroidism.

The hereditary tendency in goitre and uterine myomas is often striking. We have two sets of cases of this combination of lesions, showing family tendencies which it might be well to report at this time. One series was found in a family of seven daughters, in which a number of aunts and cousins on the father's side had goitre. The mother of the seven daughters presented a negative history so far as goitre and uterine growth were concerned. Of the seven daughters, six had palpable uterine myomas, and five had had hysterectomies performed. Four of the six sisters had palpable and prominent goitres; one required thyroidectomy after hysterectomy.

One of these seven cases was seen in consultation by Friedrich Müller and Prof. Amman in Munich; there was an enormous uterine myoma with a large goitre of the mixed type. In this case both Müller and Amman recommended the removal of the uterus first: the careful watching of the thyroid to note the influence of the removal of the former upon the latter. Both believed that they had experiences which justified the conclusion that possibly the goitre might undergo some atrophy. Dr. Howard Kelly removed the uterus; cautious watch of the thyroid followed; the hysterectomy had absolutely no effect upon the thyroid mass; in fact, it seemed to stimulate its growth, and one year later, because of moderate pressure and slight exophthalmos, Dr. Tinker removed the enormous goitre successfully.

In the second series of cases we found two sisters, the daughters of a mother who had a large goitre, both suffering from typical exophthalmic goitre. In both the uterus was the size of a large grape-fruit, and was fibromyomatous.

The influence of the removal of the goitre upon the uterine mass so far as we have been able to conclude from a cautious observation of these and other cases during a considerable postoperative period has been practically negative. With Dr. Tinker, we have watched a number of cases during the past two years which have

chanced to consult both of us, and we have had abundant opportunity to note the influence of thyroid operations upon coincident uterine growths. In none of these has thyroidectomy or ligation of the thyroid artery shown the slightest influence on the size of the uterine growth or the symptoms dependent upon its presence. In one case in which Dr. Tinker ligated both thyroid arteries in which there had been profuse menstruation during a long period, in spite of improvement in the general condition and the heart, with increased ventricular strength, menorrhagia persists uninfluenced.

In some of our cases we have found multiple fibroid growths in various organs of the body. In one operated by Dr. Jacobson, in 1901, the primary growth associated with goitre was found to be innocent, about the size of an English walnut in the left vulvovaginal gland. Since that time this patient, who is now passing through the menopause, has developed, with persisting enlargement of the thyroid, acute exacerbations of symptoms, including paroxysmal tachycardia and enormous uterine myomas. She refuses operation.

In another case we have practically the same history, with multiple pigment deposits in the skin covering the thorax, abdomen, and a large crop of pedunculated cutaneous fibroids.

The symptoms dependent upon the uterine growth with thyroid enlargement are variable and not materially different from those associated with the uncomplicated cases. It is exceedingly difficult to determine the influence of the enlarged thyroid or hyperthyroidism upon the symptomatology of uterine growths because of the irregular behavior of the latter in the majority of uncomplicated cases. We think we are safe in concluding that in the presence of thyroid enlargement and uterine growths, operations on one of these organs does not materially influence the progress of the growth in the other nor the associated symptoms, save as the general condition of the patient is improved by the removal of an impediment and the source of toxemia. We are fully aware of the fact that this has not been the universal experience of clinicians, and that some surgeons have pointed, with a great deal of confidence, to the report of Wettergren's case, in which the removal of a submucous myoma favorably influenced Graves' disease.

A large number of uterine growths are associated with tachycardia and other circulatory anomalies. In some of these cases there is a palpable thyroid, in other cases there is no evident enlargement of the gland. In some an apparently normal thyroid may become tender and slightly enlarged during the presence of tachycardia. There may be localized tenderness, with slight enlargement of one lobe of the thyroid. In all of these cases we must investigate cautiously to determine the factor which has ungeared the circulatory system. In the presence of several of

the symptoms of hyperthyroidea or perverted functions and the absence of other causes, though there is no evident goitre, we favor strongly the thyreogenous origin of the tachycardia. This subject has recently been fully considered and the literature reviewed by von Jaschke.

The blood-pressure in cases of goitre associated with uterine growths is either normal, slightly elevated, in occasional cases only little reduced. Hyperthyroidea is not a hypotensive disease, neither can it be considered hypertensive. The revelations of the sphygmomanometer are often surprising, for with a thin, small pulse, a mere thread, uncontrolled tachycardia, often with ventricular dilatation, the blood-pressure shows no fall. This is a conservative measure of Nature.

It is the object of this paper to call the attention of the profession to the large proportion of uterine growths associated with goitre, typical and atypical exophthalmic goitre, to impress further the frequency of the atypical cases, and to encourage the thorough examination of all the organs of the body in the presence of goitre, large or small; if this be done, the number of associated anomalies will prove surprising.

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## A PECULIAR UNDESCRIBED DISEASE OF THE NERVES OF THE CAUDA EQUINA.[1]

By Foster Kennedy, M.D., F.R.S. (Edin.),

associate physician to the new york neurological institute,

and

Charles A. Elsberg, M.D.,

surgeon to the new york neurological institute.

with a pathological report.

By Charles I. Lambert, M.D.,

pathologist to the manhattan state hospital, new york.

Lesions of the conus and cauda equina give rise to symptoms easily recognizable; their precision is such as usually to make plain the topographical diagnosis of affections of these areas.

The characteristic symptom-complex consists in a paralysis of the bladder and rectum, a segmental palsy of the anterior tibial muscles of the lower motor neuron type resulting in drop-foot, with, in the majority of cases, a loss of sensibility in the affected root areas. In moderately complete cases this comprises a roughly semicircular area over one or both buttocks, corresponding to the

[1] Read at the meeting of the American Neurological Association, at Washington, May 5, 1913.

third, fourth, and fifth sacral root areas, a strip down the back of the thigh corresponding to the second sacral root area, with at times similar loss in the leg below the knee corresponding to the areas under the sensory control of the lower lumbar roots.

From conal lesions these symptoms are usually bilateral; from caudal lesions they may or may not be so, depending upon the type of morbid process at work.

A tumor lying on the roots and producing bilateral symptoms must of necessity be so large as to be aggressively obvious on inspection. If no tumor be found, there may be evidence of a meningomyelitis or of old disease of the bony spine, due to trauma, newgrowth, tuberculosis etc. If we cannot obtain such evidence from clinical and laboratory methods and from examinations on the operating table or in the postmortem room, we are compelled to hypothecate a more or less diffuse disease of the roots suggesting an infection or intoxication as a causative factor. And finally, if in cases of a certain clinical type we consistently find a characteristic lesion of the roots on the operating table, we are justified in concluding that that lesion is causative of the symptom-complex present.

During the past five years in a large number of spinal operations under our observation, 84 of which were performed by one of us, and among which were many cases of diseases of the terminal spinal segments, we have met with 5 cases so alike in their histories, in their clinical findings, and in the morbid appearances on the operating table that we have been led to class them together, in the belief that we have here a definite clinical and pathological entity.

Case I.—Morris K., aged forty years, service of Dr. Collins at the New York Neurological Institute. Admitted May 27, 1910. Eighteen weeks before admission while bending down the patient felt a severe pain in the small of the back. The following day the pain in the back had disappeared, but he began to have pain in the right lower extremity. The pain came on in attacks, and extended down the thigh and leg to the ankle. It persisted off and on for four weeks, and then disappeared, to return with great severity a few days later. For ten days the pain in the leg disappeared, but there was a burning sensation over the right hip. The pain around the hip was severe enough to keep him in bed for three weeks before his admission to the hospital. For two weeks the right leg felt weak. On May 6 he was unable to pass his urine and had to be catheterized, and from then on he had great difficulty in urinating. For some time the patient noticed that he could not walk more than three or four blocks without getting tired. No symptoms were referable to the left leg. Bowels were markedly constipated.

The patient is married and has healthy children. He denied any syphilitic infection.

On examination he was found to be a strong, healthy-looking man. When he attempted to stand or walk it was evident that the right lower extremity was weaker than the left. The cranial nerves and the upper extremities were normal. Abdominal reflexes were lively and equal on both sides. The right lower extremity was slightly thinner than the left.

Knee-jerks were exaggerated on both sides; ankle-jerks could not be obtained; no clonus; plantar: right, extensor; left, flexor.

There was no rigidity or tenderness of the spine.

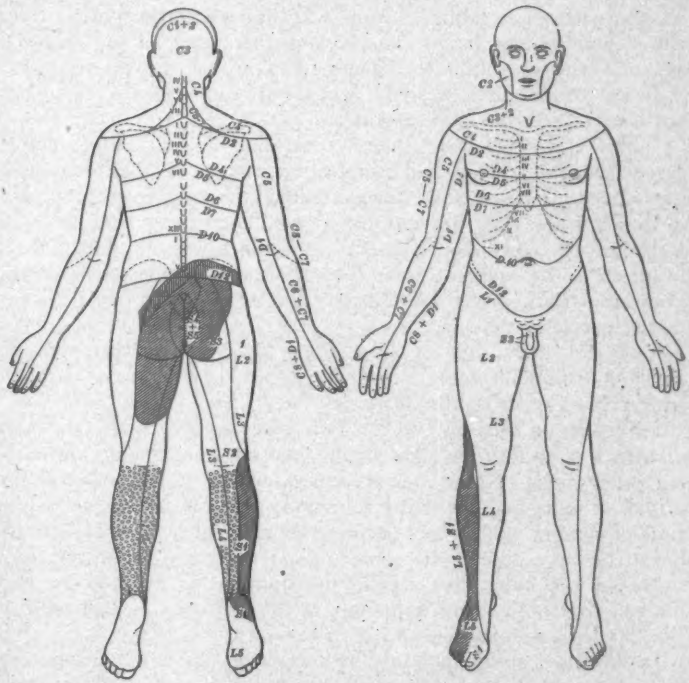

FIG. 1.—CASE I. Oblique shading, marked diminution of tactile and pain sense; verticals, hyperesthesia; circles, diminution of thermal sensibility.

There was a marked diminution of all sensations over the right side of the penis and scrotum, also over parts of the anal region, buttocks, and lower limbs (Fig. 1).

Wassermann test and *x*-rays were negative; urine was normal.

June 2. Laminectomy (Dr. Elsberg). Removal of spinous processes and laminæ of the first, second, and third lumbar and later of the twelfth dorsal vertebræ. Bone normal; outer surface of dura normal, pulsating strongly. After incision of the dura, escape of a

large amount of cerebrospinal fluid. As soon as the dura was opened, several of the nerve roots were observed to be swollen and of a bluish-red color, contrasting markedly with the other roots of the cauda equina. It was not definitely determined *which* roots were affected, but four or five presented an abnormal appearance. Careful search in the spinal canal was made for a tumor, the nerve roots being lifted out of their bed so that the spinal canal could be well examined. The twelfth dorsal arch was removed and the dural incision extended upward so as fully to expose the conus. No neoplasm was found. The affected roots were thoroughly washed with warm saline solution, and the inner surface of the dura was examined and found smooth and glistening. Then followed suture of the dura, muscles, fascia, and skin in the usual manner.

June 10. Wound dressed, primary union, sutures removed; patient catheterized since operation.

June 20. Out of bed; general condition excellent; area of disturbed sensation on legs had disappeared; area on buttocks remained unchanged. Patient could flex and extend his spine freely; the pain in the back and right hip had disappeared entirely, so that he could walk around freely; could empty his bladder without difficulty.

June 29. Discharged; area of anesthesia over buttocks was still present; sensation over scrotum was normal. Patient declares that he felt perfectly well.

CASE II.—Mrs. St. J., aged thirty-seven years, married, no children, a patient of Dr. Brooks Wells and of Dr. Dana, through whose courtesy we report this case.

First seen on May 21, 1912. Two years before the patient had an attack of pain in the right thigh, shooting from the hip and lasting nine weeks. About one month later she had another slight attack of pain, and thereafter had some pain off and on up to the time of coming under observation. About eight months before she began to have pain in the small of her back and in her rectum. Later she was more than usually constipated. In January she had noticed that both lower limbs felt weak; had considerable pain in the left leg and numbness in both knees.

In April an abdominal hysterectomy was done, on account of difficulty with her bladder and rectum. She recovered satisfactorily from the operation, but her symptoms were unrelieved and steadily became worse. After operation she had retention of urine for three days, then she regained control of her bladder for two weeks; from that time on she lost all control of that organ and had to be catheterized. From May 14, she had severe shooting pain in the right leg and in the back, and noticed that her right leg felt stiff when she attempted to move it, and that she did not feel the catheter when the urine was withdrawn. Her bowels were constipated, excepting after a cathartic, when incontinence prevailed.

She was confined to bed for several weeks before our seeing her, on account of the pain and weakness of her lower limbs.

On examination the patient was a woman of small stature and slight build. Cranial nerves and upper extremities were normal.

Abdominal reflexes were present and equal.

Flexion of the right thigh at the hip and dorsi flexion of the right foot was weak. Knee-jerks were present and equal; ankle-jerks were present on the left, could not be obtained on the right side. The muscles of the right thigh were flabby. No loss of deep muscle sense in lower limbs.

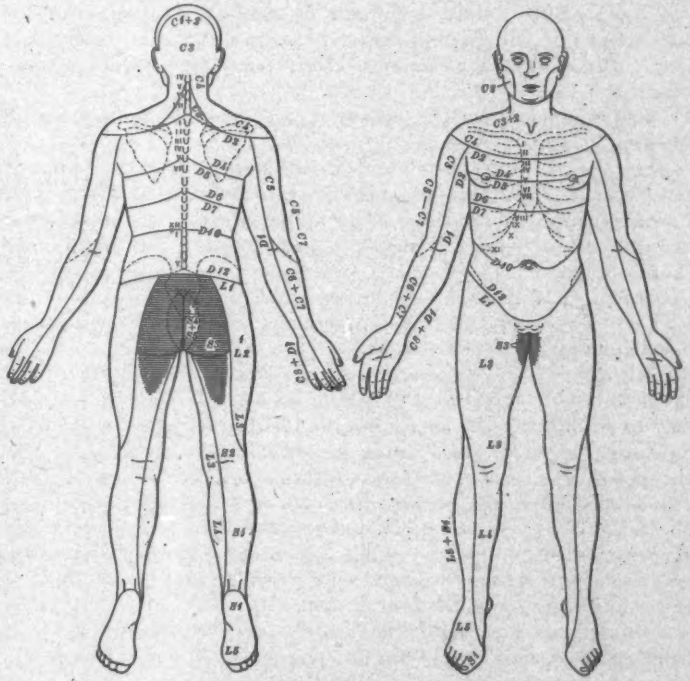

FIG. 2.—CASE II. Area of loss of all sensation.

At a second examination several days later, ankle-jerks on both sides could not be obtained; there was a loss of all sensation over the second, third, fourth and fifth sacral areas on both sides (Fig. 2). Wassermann test was negative; fluid obtained by lumbar puncture was of a light yellow color; globulin increased, 20 cells to the cubic millimeter; *x*-ray examination was negative.

June 18. Laminectomy (Dr. Elsberg). Removal of spinous pro-

cesses and laminæ of the eleventh and twelfth dorsal, and the first, second, and third lumbar vertebræ in the usual manner; when the dura was incised, considerable fluid escaped, and the roots of the cauda equina were found deeply congested and of a reddish-blue color. Numerous tortuous vessels ran between the nerve roots. The inner surface of the dura showed a few small spots of congestion, but everywhere it was smooth and glistening. All sides of the nerves of the cauda, of the conus, and of the lumbo-sacral cord were examined, but no evidence of a tumor, of a bony abnormality, or other lesion could be found. A probe was passed upward and downward without meeting any obstruction. After the toilet of the wound, bichloride of mercury solution, 1 to 500 was rubbed on the nerve roots, and the dura, muscles, fascia, and skin closed in the usual manner. Duration of the operation, forty minutes.

Convalescence from the operation was uneventful; the wound healed by primary union.

June 26. For the past few days the patient had been able to feel when her bladder was distended. She once passed several drams of urine voluntarily. After taking a cathartic she still had incontinence of feces. Had not had any pain in her lower limbs since operation.

September 1. Had gained almost complete control of her rectum, and at times could pass urine voluntarily. Was free from all pain. Both ankle-jerks present, but weak.

February, 1913. General condition was excellent; had gained much flesh and strength. Passed urine without trouble, but had four to six ounces of residual urine, and had to be catheterized occasionally. She had considerable sensation when her bladder was distended and some urethral sensation had returned. Bowels moved well after small doses of cascara, and she was conscious of the desire to go to stool. Had occasional pain in her right leg. Knee-jerks were lively and equal; left ankle-jerk was lively, right was weak, but distinct. There were irregular areas of diminished sensation over the third, fourth, and fifth sacral areas, but they were indefinite, and their limits could not be mapped out. In some parts of these areas sensation was good while in others it was poor. Vulva was sensitive to touch and pain. Patient said she felt the catheter plainly when it was inserted and withdrawn. Could recognize the temperature of an enema, and declared that she was much better than when last seen.

Case III.—Elizabeth B., aged forty-five years, service of Dr. Peterson, at the Neurological Institute. "Sciatic rheumatism" in right hip for two years before admission, of about three months' duration. Soon after this the patient noticed that her right lower limb was becoming weaker, so that she dragged it after the other when walking. At about the same time she began to have pain in

her ankles, chiefly on the right side. The pain in the right hip returned at times, but gradually disappeared after about one year from the beginning of her trouble. From October, 1911, she had a recurrence of the pain about the right hip; thereafter it became steadily worse. At first the pain came on in attacks, but later it was continuous. From February, 1912, the right leg became much weaker. The pain in the ankle also reappeared, as did pain in the other ankle. For six months she had attacks of severe pain in the small of the back and became constipated. She had frequency of urination for many years before the onset of her symptoms.

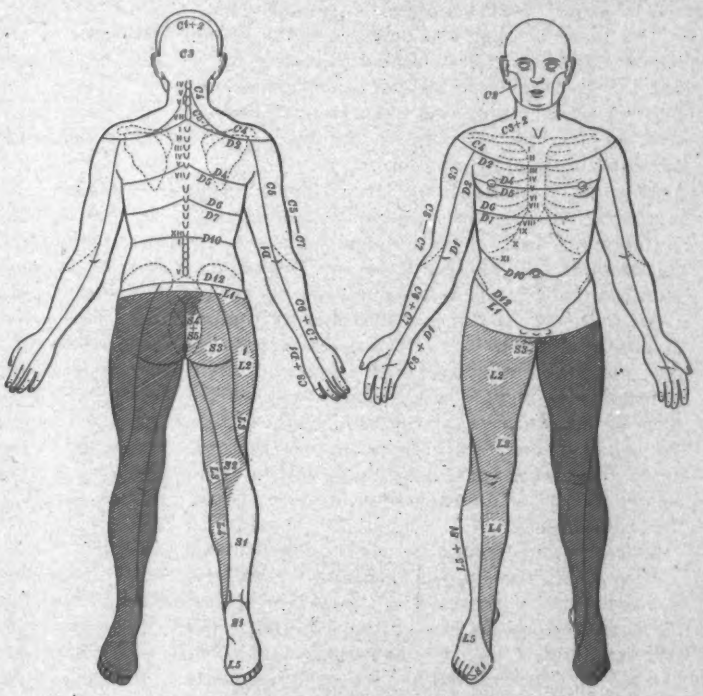

FIG. 3.—CASE III. Elisabeth B. Almost complete loss of all sensation; close shading, marked loss; wider shading, moderate loss

*Physical Examination* (May 27, 1912). General condition good; well-nourished; patient could walk only with great difficulty; she needed support on both sides. Both legs were spastic. Cranial nerves and upper extremities were normal. Abdominal reflexes, left upper and lower, were weak; right upper and lower could not be obtained.

Lower extremities: power fair at ankles on both sides; flexion

and extension at left hip and knee good; flexion at right hip and knee poor; the patient could raise both limbs from the bed, but the right always lagged behind the left. Both knee-jerks exaggerated; the right more than the left; both ankle-jerks were exaggerated and equal; double ankle-clonus, exhaustable on the left side; right plantar reflex extensor; Oppenheim sign on the right side; double paradoxical adductor reflexes were most marked on the right side when the left patellar tendon was tapped. No loss of deep muscle pain sense in lower extremities. The muscles on the outer side of the right thigh were tender to pressure.

For sensory disturbances see appended chart (Fig. 3).

The lumbar spine was held rigid; the spinous processes of the twelfth dorsal and first lumbar vertebræ were tender to pressure and the first lumbar spine was somewhat prominent.

*x*-ray examination was negative; Wassermann test was negative; no increase of cells or globulin in the cerebrospinal fluid obtained by lumbar puncture.

May 28. Laminectomy (Dr. Elsberg). Spinous processes and laminæ of the eleventh and twelfth dorsal and of the first lumbar vertebræ and later of tenth dorsal removed. Dura was incised and considerable fluid allowed to escape. Cord pulsated well. Lumbosacral cord and conus covered by a fine network of congested vessels.

All the roots of the cauda equina were of a pinkish-blue color, unlike the normal color of the roots, and seemed to be covered by fine, congested vessels. Inner surface of the dura seemed to be congested in spots. Careful search was made for a tumor on all sides of the lumbosacral cord and conus and beneath the roots of the cauda equina, but nothing further abnormal was found. The nerve roots were thoroughly rubbed with sponges dipped in 1 to 500 bichloride of mercury solution, and the wound was closed in the usual manner.

Convalescence from the operation was uncomplicated.

June 7. The patient was up and about, and there was considerable improvement in her walking. Power in both limbs was fair, but the right was much weaker than the left. Both knee-jerks were still exaggerated, but the ankle-jerks were normal, without clonus. Double Oppenheim reflex. Sensory examination revealed some improvement.

June 28. Was able to walk around the ward without help. Power in both limbs was fair but the right was still weaker than the left. Both knee-jerks were exaggerated, the left more than the right. Both ankle-jerks were active; no clonus, Babinski sign and Oppenheim sign on right side. Spasticity in lower limbs was slight. Sensation in lower limbs (Fig. 4) was distinctly improved. It was impossible to find any definite loss of tactile sense, and the disturbance in the pain sense was indefinite, so that the examiner was often in doubt as to whether the pain sense was really disturbed. No

definite areas could be mapped out. Power in right limb was much improved. Patient could raise the right limb from the floor much better. To this fact she spontaneously referred.

July 12. Continued to improve, but complained at times of pain in the back. The spasticity of the right lower extremity was much less, and the power in the extremity was much greater.

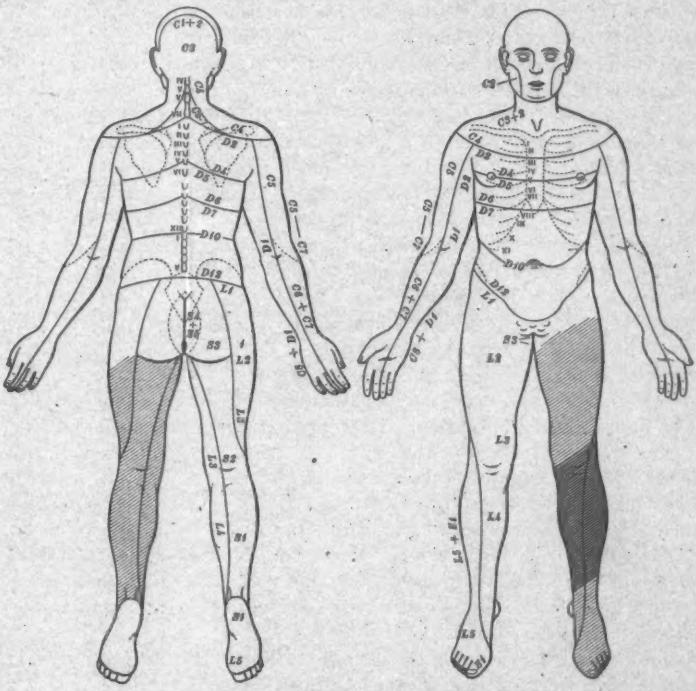

FIG. 4.—CASE III. Elizabeth B. Showing marked improvement four weeks after the operation. Compare with Fig. 3.

CASE IV.—Percy M., aged forty-four years, married, minister, service of Dr. Collins at the Neurological Institute.

The following history was obtained from his family physician, Dr. Vanderpoel Adriance: "In 1893 the patient had a fistula in ano, which was operated upon and the sphincter severed. He had suffered from nasal catarrh and inflammation of the left frontal sinus, for which he had been treated by irrigation and catheterization. Had had attacks of asthma and a number of attacks of so-called lumbago. Five years before while climbing in the Alps, he fell, striking upon the lower end of the spine; he suffered for several

days, but recovered without trouble. He thought nothing of the injury at the time, and recalled it only when questioned.

"Three years before, in the autumn, the patient came to this country, and while lifting a heavy article of furniture, felt a sharp pain in the back and down the back of the right leg. It had the distribution of "sciatic" pain. In December of that year, while skating, he fell heavily upon his back and had severe pain for several hours. After this injury the pain in the back of the leg appeared to have become worse. In March, 1910, that is, three months after the fall, he was sent to Dr. Goldthwaite, who made a diagnosis of right sacro-iliac strain, and applied a brace with a pad over the pubes and sacrum. At this time he was suffering from nervous depression, and this depression has remained ever since. Had a bad attack of asthma the following autumn.

"In the autumn of 1911, the patient, without apparent cause, had an attack of what appeared to be sciatica in the right limb. This was accompanied by numbness in the large toe and foot.

"In November, 1912, while getting out of his bath, he was rubbing his back with a bath towel, the ends being held in the hands, when the pain in the right leg suddenly returned. Since that time the pain has persisted, and at times shifts from the back of the right to that of the left leg. The patient was taken to New York, where an eminent orthopedist was consulted, and an *x*-ray taken. The bones in the lumbosacral region appeared normal on the plate."

The pain soon disappeared from the back but remained in the lower extremities, and he had a feeling of pins and needles in both feet and numbness in the buttocks. These symptoms persisted unchanged up to the time of his admission to the hospital.

November 17. Patient was in a much depressed mental state. Signs of old frontal sinusitis on the left side. Marked arcus senilis. Heart and lungs were negative; cranial nerves and upper extremities were normal.

Upper and lower abdominal reflexes were present and equal; cremasteric reflexes were present on both sides, but weak.

February 5, 1913. Patient complained only of pain caused by his cystitis, which had been severe in spite of frequent bladder irrigations. There was considerable atrophy of both lower extremities, more marked on the left side; complete foot-drop on both sides. The patient was able, with great effort, to flex each thigh on the abdomen to a slight extent, and he could weakly flex the legs on the thighs. All motor power was evidently much reduced. He was able to flex and extend the toes a little. He was not able to stand or walk.

Knee- and ankle-jerks absent; no plantar response. Abduction and adduction of the right thigh was weak; on the left side it was somewhat stronger. The limbs could be rotated outward fairly well, but inward rotation of the thighs was very poor.

There was a marked loss of sensation over all the sacral areas on both sides; much more marked on the left side (Fig. 5). Marked reaction of degeneration in the muscles of both lower extremities; loss of postural sense in the left foot.

X-ray examination was negative. Wassermann test was negative. No increase of cells or globulin in the cerebrospinal fluid obtained by lumbar puncture.

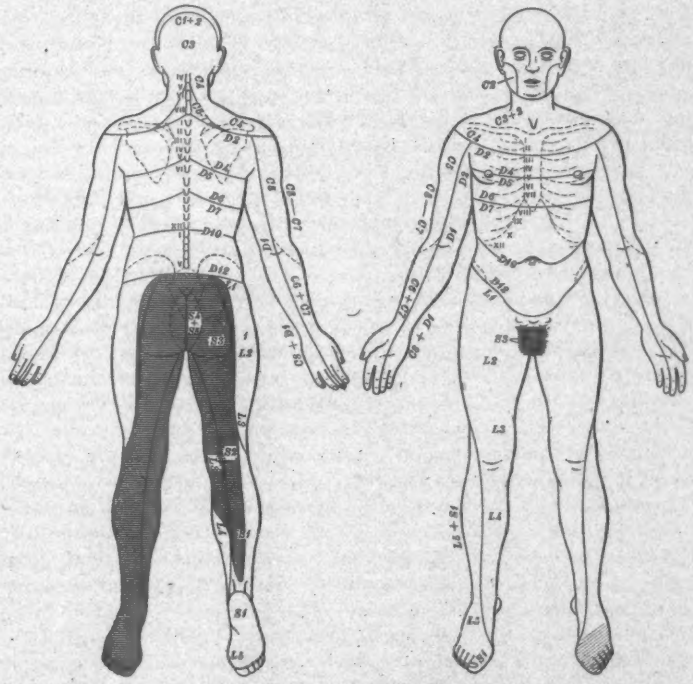

FIG. 5.—CASE IV. Complete loss of all sensation over shaded area.

February 5. Laminectomy (Dr. Elsberg). Removal of spines and laminæ of eleventh and twelfth dorsal and first and second lumbar vertebræ. Laminæ were very thick, but normal. Dura appeared much distended with fluid and did not pulsate. After incision of the dura a moderate amount of cerebrospinal fluid escaped. All the roots of the cauda equina were markedly congested, were of a reddish-blue color, and somewhat swollen. When the dura was incised upward a larger amount of fluid escaped, and it was seen that a number of the roots were bound together by fine adhesions. At about the middle of the cauda there was a slight narrowing of

the roots, as if an adhesion had existed at this point. Careful exploration failed to reveal a tumor within the spinal canal or any abnormality of the bony framework. A probe was passed upward within the dura for a considerable distance without meeting with any obstruction. The inner surface of the dura was everywhere smooth and glistening. The roots were thoroughly rubbed with bichloride of mercury solution, 1 to 500, followed by adrenalin solution, and the wound was then closed in the usual manner.

March 15. Wound healed by primary union; convalescence from operation was uneventful. The patient was much troubled by his bladder pain, but this was relieved by the insertion into the bladder of a permanent catheter. There was a slight contraction of the right quadriceps when the patellar tendon was tapped. The patient was able to be out of bed in a chair, and had been able a few times to pass urine in small quantities. He was able to control his movements.

April 24. For the past month the patient had been able at times to pass a fair amount of urine, voiding as much as six ounces at a time, with effort. He complained of pain in the bladder region. Cystoscopy showed that he still had a marked cystitis, with paralysis of the vesical neck. He was not certain if he had sensation in the bladder and rectum during urination and defecation. Abdominal reflexes were lively and equal; power in lower extremities was decidedly improved. He could raise both legs vertically from the bed, although the left was evidently weaker than the right. Flexion of thighs at the hip was good; flexor power at the knees was weak; the left was weaker than the right; extension at knees was strong; abduction of the thighs was weak; adduction was excellent. Double foot-drop persisted. Right knee-jerk was present and weak; left could not be obtained. Ankle-jerks were absent. Deep muscle pain sense was good in both lower limbs. Has not had any erections or sexual feeling for six months. The sensory disturbances were unchanged from those charted before the operation.[2]

Case V.—F. K., aged thirty-seven years, was admitted on June 18, 1912, to the Cornell Medical Division of Bellevue Hospital under the care of Dr. C. L. Dana.

He had had no previous illness; no history of either gonorrhea or syphilis. Had never suffered injury; never drank whisky; drank two glasses of beer daily. His one constant habit was tobacco chewing.

In the middle of April, 1912, he began to experience tingling pains "like needles" in both legs below the knees. These persisted, and to them were quickly added sharp cramp-like pains in the calves and in the backs of both thighs. He then began to suffer from numbness and weakness in the feet and ankles, with consequent

[2] Dr. Collins considered that the patient had a toxic affection of the cauda equina, due to some general condition.

difficulty in walking. He would frequently trip over small obstacles in his path, a circumstance explained by the rapid onset of double drop-foot. For two weeks before admission he had occasional incontinence of urine and feces. No symptoms were referable to the upper extremities nor to any of the cranial nerves.

Examination showed a thin, ill-looking man, appearing older than the age stated. Arcus senilis was present in both eyes.

Cranial nerves and upper extremities were normal.

Abdominal reflexes were depressed, but equal, on the two sides. Cremasteric reflexes were absent on both sides. Knee-jerks were present and equally depressed; ankle-jerks were absent. Plantars: sometimes of flexor, sometimes of extensor type. No ankle-clonus. Some wasting of all the muscles of the lower extremities, but marked atrophy of the anterior tibial muscles on either side. Bilateral foot-drop. No anesthesia or analgesia; temperature sense normal. No diminution in deep muscle pain sense; complete loss of postural sense in the toes of both feet.

The urine showed a faint trace of albumin; no sugar; a few hyaline casts.

The cerebrospinal fluid was clear and showed two lymphocytes to the cubic mm.; no tubercle bacilli; Noguchi and Wassermann tests were negative. The Wassermann test in the blood-serum was also negative. The blood-picture was that of a mild secondary anemia, with a hemoglobin percentage of 74. Considerable pyorrhea alveolaris, than which no other septic focus could be found.

From the date of his admission this patient's condition grew steadily worse. Paralysis was progressive, so that on July 26 there was marked weakness in the thigh muscles, this being more evident on the right than on the left side. Wasting had become so marked that it was difficult to say whether or not it was localized, and of segmental or root type.

The abdominal reflexes were present, but weak in all four quadrants. Cremasteric reflexes were absent; knee- and ankle-jerks were absent. Plantar reflexes bilaterally were of extensor type.

All forms of sensibility were then found to be lost in the second, third, fourth, and fifth sacral root areas of both sides, and markedly diminished on the right side in the third, fourth, and fifth lumbar and on the left side in the fourth and fifth lumbar root areas alone. (Fig. 6.) Postural sense; five errors in five trials in the toes of both feet.

Sphincter reflexes; bladder, complete retention; rectum, complete incontinence.

On July 29 Dr. Hartwell operated. The laminæ and spinous processes of the ninth dorsal to the fourth lumbar vertebræ were removed. A careful search failed to reveal any tumor growth, but the conus and the caudal roots were seen to be much swollen and of a deep red color.

The patient failed to rally adequately after the operation; the lungs became edematous, and on August 12 he died.

Permission was granted to enlarge the wound made by operation. This was done by Dr. Hall, who succeeded in removing the major part of the cord, with its roots; the sacrum and its foramina were found to be macroscopically normal. Weigert-Pal sections showed inadequately an ascending degeneration, especially in the posterior columns. This degeneration steadily decreased as one went upward.

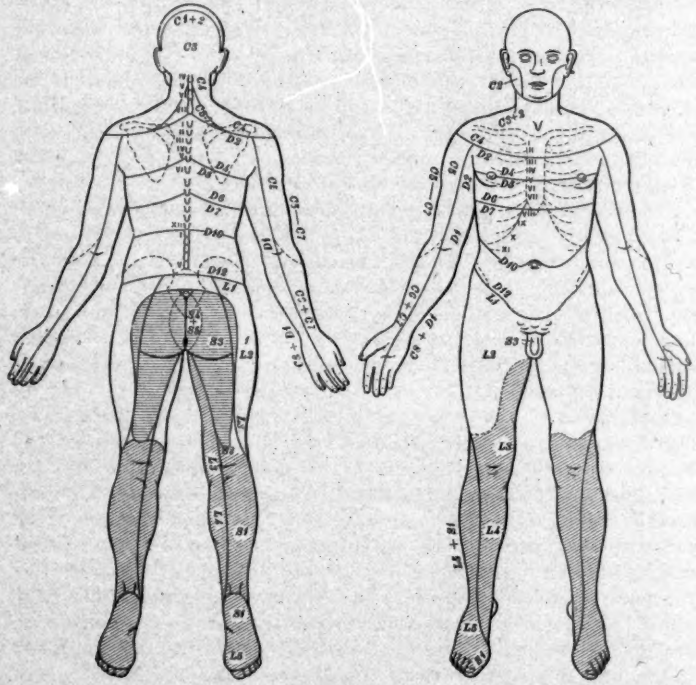

FIG. 6.—CASE V. F. K. Transverse shading, complete loss of all sensation; oblique lines, marked diminution.

ANALYSIS OF SIGNS AND SYMPTOMS. The histories of these five patients, while they are spread over various periods of time, are almost exactly alike in the nature and sequence of incident. In the third and fourth patients the symptoms were progressive in each for about two years, in the second for about one year, and in the first for but six months.

Pain was present in all from the beginning; it was sharp, shooting, and burning in character, and was felt almost entirely in the backs

of the thighs and in the calves. By the last patient it was described also as needling and cramp-like. In the first four patients the pain was, at the beginning, strictly unilateral, being felt in both legs after the lapse of some weeks or months. The leg first involved remained throughout the illness more affected than its fellow. All but the third patient complained much of tingling and numbness, involving sometimes the feet, sometimes the knees, and in the last two patients the entire surface of the lower extremities.

Atrophy of the anterior tibial muscles, with loss of the power of dorsiflexion at the ankle, was a prominent feature in four of the series; in the exception (Case III) there was a spasticity of the lower extremities, which was more marked on the right than on the left side. This was an important deviation from the symptom-complex, as we have become accustomed to recognize it, but the characteristic pains, the sensory changes, and the lesion of the caudal roots, identical with those of the other patients, furnish just evidence for the alignment of this patient in our series.

The objective sensory changes showed an astonishing uniformity; in all, the main incidence of the disease had fallen on the lowest roots of the cauda, the sacral roots were always affected, and with the utmost severity. In one patient (Case III) all the lumbar roots were also involved though to a somewhat lesser degree than were their more lowly placed fellows. In three only had the lowest lumbar roots become diseased to such an extent as to abolish or depress function.

As would be expected, the more markedly the lower sacral roots were involved the more complete was the sphincter disturbance. The disorganization of the functions of the bladder and rectum was complete in all but the third case, in which precipitancy and frequency of micturition prevailed. In that case, however, the destruction of function of the roots as gauged by the morbid sensory findings, while more diffuse than in any of the others, was considerably less complete.

The first, third, and last cases showed that disease had produced destructive changes in the cord itself; in them the plantar reflex was of the pathological extensor type.

The abdominal reflexes were present in all of the patients. In but one were the ankle-jerks obtained in the affected limbs. The knee-jerks became lost, as in the last case, coincident with the upward progress of the disease.

None of the patients gave either a history or indication of luetic infection. In all, the Wassermann test was carried out in both the blood and cerebrospinal fluid, with completely negative results in every instance.

In only one case did the cerebrospinal fluid give any indication of the presence of a disease condition within the dura, and in it (Case II) it was of doubtful interpretation, showing a negative

Wassermann test and an increased amount of globulin, with twenty lymphocytes per cubic centimeter, a cytological count, insufficient to accompany any tuberculous process.

Anatomical Findings. The conditions found at operation were the following: In two patients a large number of the caudal roots and in the other three all the roots were swollen, congested, and of a bluish-red color (Fig. 7). The difference between the color of these nerves and the color of the normal nerve roots was striking and easily recognizable. The changes seemed to be due to an intense hyperemia on the surface of the nerves, and extended into the nerves themselves. In one patient (Case 4), in whom a piece of posterior root was excised for histological examination, the entire nerve on cross-section looked discolored. Fine bloodvessels hardly visible to the naked eye could sometimes be traced upward on the nerve roots to the conus, where they formed a fine net-work in the pia mater.

Adhesions between the nerve roots were present in only one case; in the others the only changes were swelling and discoloration.

In all five patients the inner surface of the dura was smooth and glistening, and without signs of inflammatory change though in two of them a few small areas of hyperemia were observed. No gross change was observed in the conus or lumbosacral cord.

The cerebrospinal fluid was normal in appearance in four patients, while in one the color was more yellow than is usual. The amount of fluid which escaped when the dura was incised was considerable in several of the cases, but was no more than one often finds within the dural sac.

Pathological Report. Case IV.—Percy M. A small fragment, 1½ by 7 mm., of one of the posterior sacral roots was received in formalin. Preparations were made after Marchi's method and the Mann-Alzheimer and Mallory-Jacobson methods. In the Marchi preparations a low grade myelin sheath degeneration was present, involving approximately one in twelve or fifteen of the nerve fibers. With the Mann-Alzheimer stain relatively the same proportion of nerve fibers appeared to be affected, the axis-cylinders showing various degrees of swelling, loss of normal staining reaction, some of them showing granular degeneration, fragmentation, and absorption.

The danger of mechanical injury in the manipulations necessary for removal of the nerve root which might produce certain artifacts, resembling a true Marchi reaction, probably can be excluded, and though the material was limited in amount, the preparations appeared fully convincing for the changes described.

Case V.—F. K. The spinal cord was received in formalin. There was some distortion in fixation of the lumbosacral cord, and identification of nerve roots and segments was uncertain. The external appearance of the cord was not remarkable, except that the dura

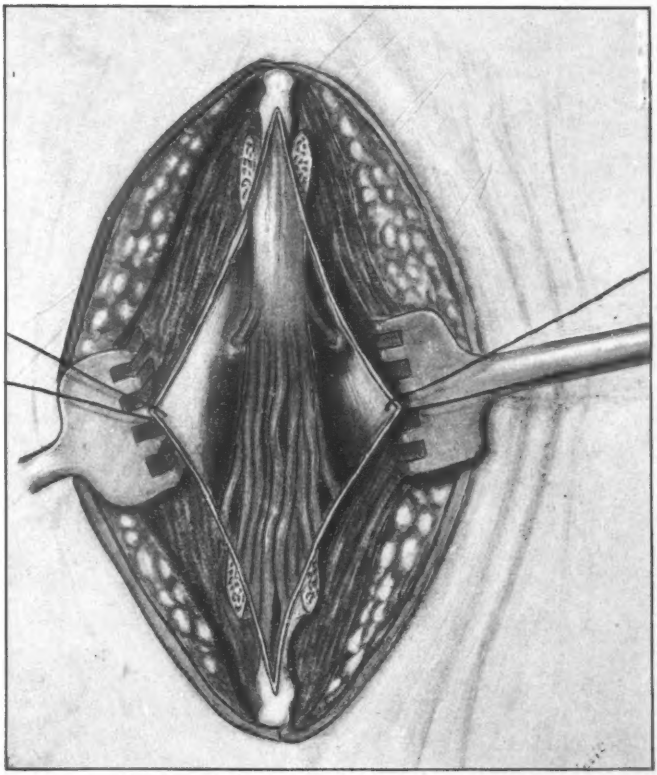

Fig. 7.—Case II. Mrs. St. J. Characteristic Swelling and Discoloration of the Nerves of the Cauda Equina

covering the cauda equina was congested, and on cross-section appeared moderately thickened.

The dorsal roots of the cauda equina were considerably injected, the central as well as peripheral vessels of the individual nerve roots standing out as black points. There were light adhesions between the posterior sacral roots, due apparently to an increase of the intervening tissue. Only portions of the lumbosacral root ganglia were present. The vessels of a number of these roots were considerably engorged; one of them contained a blood-clot about 6 mm. in diameter in the centre of the nerve root, just proximal to the ganglion.

FIG. 8.—Mann-Alzheimer axis-cylinder stain of a posterior sacral nerve root. Showing (*a*) swelling, (*b*) degeneration, and (*c*) absorption of the axis-cylinders as observed in cases F. K. and Percy M.

On transverse section of the cord the marginal afferent tracts appeared rather translucent. Slices were taken from the cervical, thoracic, and lumbosacral regions of the cord and from the cauda equina for alcohol embedding, for Weigert and for Marchi studies; other slices from the same regions were placed in a fluochrome-copper acetate mixture for neuroglia and axis-cylinder stains, and frozen sections were prepared with Herxheimer's Sharlach R stain and Spielmeyer's myelin sheath stain.

A summary of the microscopic findings follows: The meninges

of the cord at all levels were free from any lymphoid or plasma-cell infiltrate, and there was no evidence of syphilitic meningitis or endarteritis found at any level of the cord. In the dura covering the cauda there was some evidence of external chronic pachymeningitis and also internal serous hemorrhagic pachymeningitis, with a thin false membrane formation between the dura and pia-arachnoid. The larger spinal arteries, for example, the anterior spinal, showed a low-grade athero-arteriosclerosis. In the region of the cauda equina, however, there was a relatively high-grade arteriosclerosis involving not only the larger but the smaller arterioles

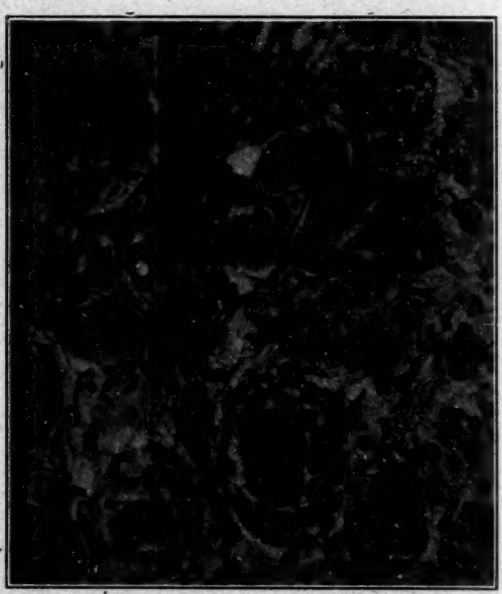

FIG. 9.—Hematoxylin and eosin preparation of one of the sacral root ganglia showing degeneration of ganglion cells, proliferation of the capsule cells, a number of which present ameloid forms, and passive or active neuronophagia.

supplying the individual nerve roots. The media and adventitia showed hyalin degeneration, the intima in its deeper portion showed similar changes; but toward the blood-stream were rather round clear cells, with vesicular nuclei, sometimes several cell layers thick. In a number of the smaller arteries and arterioles the lumina were very considerably reduced by this process. The central and marginal veins of the individual nerve roots were uniformally distended with blood; especially was this true for the posterior nerve roots of the cauda.

At the point where the dorsal roots penetrated the dura, chronic

inflammatory tissue elements, a few lymphoid cells, and fibroblasts were seen, but no plasma cells. The ganglion cells of the posterior roots of the cauda showed a variety of diffuse alterations, many of which might be regarded within the range of normal change, considering the age of the patient. A number of the cells, however, showed evidences of degeneration, indefinite irregular cell outlines with disappearance of the stainable substance, a marked increase in the amount of pigment, displacement of their nuclei, the membranes of which were often absent, and the nucleoli enlarged and vacuolar. About some of these cells the capsules were often several cells thick, and evidence of a passive or active neuronophagia was present.

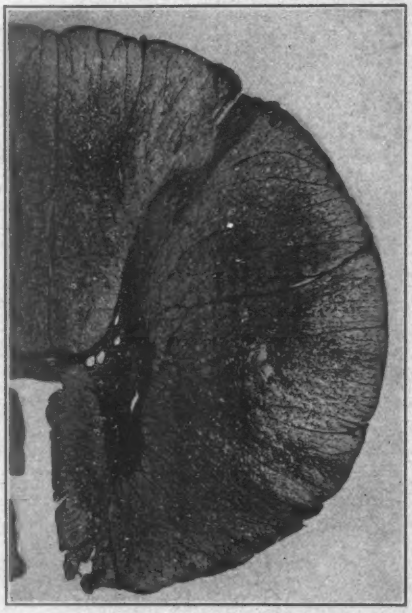

FIG. 10.—Mann-Alzheimer preparation of the thoracic cord, showing extensive degeneration of nerve fibers as well as much of the neuroglia in the ventral, lateral, and posterior columns of the cord.

A number of the posterior lumbosacral roots stained after the Mann-Alzheimer axis-cylinder methods showed a number of nerve fibers in different stages of degeneration, that is, swelling, vacuolization, granular degeneration, and absorption of the axis-cylinder as well as myelin sheath. Regenerative changes were not found with certainty. The axis-cylinder myelin-sheath degeneration appeared relatively recent, and evidences brought by the other

methods would seem to confirm this view. The total destruction of the posterior root fibers appeared limited and seemingly insufficient to explain all the root symptoms in the case.

FIG. 11.—Herxheimer Scharlach R fat-stain of the cervical end showing in addition to the degenerations equivalent to those observed in the thoracic region, the presence of granule cells in the areas undergoing degeneration.

Within the cord itself the intramedullary fibers of the sacral and lower lumbar cord segments were essentially free from myelin-sheath or axis-cylinder degeneration. In the midlumbar region and increasing in the thoracic and extending through the cervical segments there was a high-grade, complete degeneration of the nerve fibers composing the major afferent systems of the cord, namely, ventral spinocerebellar fibers, ventrolateral and dorsolateral spinocerebellar and spinothalamic fiber systems, and in the dorsal columns moderate degeneration in the dorsomedial as well as in the dorsolateral columns. The cord degenerations were essentially bilaterally symmetrical. Thus the degeneration involved both the posterior root fibers in their intramedullary course, but mainly the secondary afferent systems of the cord related to these were almost totally destroyed.

INTERPRETATION. A tuberculous or syphilitic meningomyelitis or neuritis can be definitely excluded, no lymphoid or plasma cell exudate or luetic type of endarteritis was present. In addition to the evidence of a chronic degenerative type of arteriosclerosis there was the intimal proliferation described above, which resembled or was identical with the reaction encountered in some of the acute infections or toxic processes, the intimal cells often appearing increased in number and the nuclei and cell bodies round and vesicular. The reaction is strongly suggestive of a relatively acute or subacute irritation, secondary rather than primary to the disease process.

The degeneration of the nerve fibers and cells in the posterior lumbosacral roots of the cauda equina appeared to be relatively recent in origin, days or weeks rather than months in duration, and compared to the cord involvement, minimal in severity and extent; the cord degeneration stands out distinctly as the most affected district. Whether the intraspinal fibers are more vulnerable than the peripheral root fibers or whether proportionately severer symptoms may arise from relatively slight injuries to the latter is perhaps a question.

The anatomical findings and to a degree the clinical in Case F. K., show a mixed condition, with a preponderant involvement of the afferent spinal fiber tracts.

In a complete and careful examination of the literature back to 1906, and in many authorities of an earlier date, we have not been able to find proved cases of the kind here described. Many are quoted which might be clinically relevant, but they are without confirmation by operation or autopsy. Before the era of luetic serology many of these were considered to have been syphilitic in nature, with, however, apparently often incomplete justification.[3]

One case, however, reported by Laiguel-Lavastine and Verliac,[4] clinically identical with ours, was of undoubted specific origin. There only the right half of the cauda equina was diseased, in accordance with which the patient gave a history of pain in the sciatic distribution, weakness in the leg, drop-foot, loss of knee, ankle, and plantar reflexes, all on the right side, with retention of urine and loss of all sensation in the skin areas on the right side corresponding to the fifth lumbar and all the sacral roots.

The patient gave a history of luetic infection, and in adddition to the signs already cited, had those corresponding to a previous cerebral thrombosis affecting the left side of the body. On autopsy there was found a meningoradiculitis of the right half of the cauda

[3] Gierlich, Deutsch. Zeit. f. Nervenheilkunde, xviii, 322; Cassirer, Ibid., 1907, xxxiii, 401.
[4] Rev. Neur., Paris, 1908, xvi, 179–182.

equina, with marked matting together of the roots. This inflammatory process was looked upon as being of specific character, because of the hyalin degeneration and periphlebitis of certain posterior radicular veins. There was also present an ascending degeneration in the cord affecting almost entirely the posterior columns of the right side.

This one case is sufficient to show that changes in the caudal roots as a result of lues, and perhaps tuberculosis or leprosy as well, may produce a clinical picture necessitating a topographical diagnosis identical with that in our patients; but these cases of ours, on the other hand, show that apart from the outstanding systemic diseases, there may occur degeneration and loss of function in the caudal roots with, in advanced instances, ascending degeneration in the cord as well.

It might be argued that the five cases here reported are examples of a localized specific meningitis, but opposed to this contention is the absence of either a luetic infection or luetic serological findings, and the absence of distinct meningeal changes in any one of them. In several of our patients there was a history of trauma which preceded the beginning of the symptoms by many years. In none had the trauma been of recent date, and in none had a lumbar puncture been performed so recently that the congestion of the roots could have had any connection with that procedure. As we have already stated, the operation in our cases failed to reveal any lesion either within the dura or outside the membranes, or in the bony parts of the spine, excepting the peculiar swelling and discoloration of the nerves of the cauda equina.

It is of no little interest that this same caudal discoloration has been observed in one of the lower animals, the horse. In 1909 Marek[5] published the report of a disease in a horse, with autopsy, which was in all respects similar to the disease in our patients. The animal began to have colic and to suffer from constipation. Later it developed marked weakness of the hind legs and retention of urine, with loss of sensation around the buttocks, in the anal region, and down the backs of both thighs. The patellar reflexes were depressed. The horse was killed, and at autopsy a marked congestion of the cauda equina and the surrounding pia mater was found. There was considerable connective tissue proliferation around the red and swollen lumbar and sacral nerve roots. A collection of blood external to the spinal column was evidently the result of an old trauma. Histologically the roots showed intense congestion and small round-cell infiltration, with disappearance of many of the nerve fibers. There was some ascending degeneration in the posterior columns of the lower dorsal and lumbosacral cord. Marek refers to similar cases reported by Marchand Alix and by Dexler,

[5] Zeitschrift f. Thiermedizin, 1909, xiii, 33.

in veterinary journals, but we have been unable to obtain these publications.

Marek describes the condition as a neuritis of the cauda equina. The clinical condition in our patients seems to have been quite similar to that described in the horse, and the findings at operation were very like those found at the postmortem examination in the animals.

We have, therefore, been forced to the suggestion that our cases and perhaps some of those in the literature with like histories are examples of a true toxic neuritis of the caudal nerve roots. The probable existence in man of such a disease has been contended by several writers (Balint and Benedikt,[6] L. R. Muller[7] Raymond[8]), and has been produced experimentally by Orr and Rows[9] who repeatedly have shown toxins to be capable of travelling from the sciatic and other nerves to the posterior root ganglia, along the spinal roots, and upward in the cord.

In their animals the signs of inflammatory reaction and of degeneration in the cord were inversely as the distance from the toxic focus, and were the result in each case of an infection of the lymphogenous paths.

It is our belief that our cases are examples of a morbid process akin to that produced experimentally by others, and it is our hope that in the future the study of other cases may make more plain the nature of the infection or toxemia and the possibility of its cure.

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## PRIMARY TISSUE LESIONS IN THE HEART PRODUCED BY SPIROCHETE PALLIDA.[1]

By Aldred Scott Warthin, Ph.D., M.D.,

Professor of Pathology in the University of Michigan, Ann Arbor, Michigan.

(From the Pathological Laboratory, Ann Arbor, Michigan.)

All recent statistics show a marked increase in the occurrence of cardiac disease, and various theories have been advanced to explain this increase. Alcoholism, nicotinism, nervous strain, overeating and drinking, intestinal intoxications, chronic infections, etc., have been given as the factors responsible for the myocardial affections that are seen with an apparently increasing frequency,

[6] Deutsch. Zeit. f. Nervenheilkunde, xxx, 1.
[7] Ibid., xix and xxi.
[8] Nouvelle Iconographie de la Salpêtrière, 1895.
[9] Jour. Ment. Sci., London, 1910, lvi, 86–89; Rev. Neur. and Psych., 1912, x, 405–438.
[1] Presented before the Section of General Pathology, International Congress of Medicine, London, August, 1913.

but there is little unanimity of opinion as to the relative importance of these etiological agents. That syphilis plays an important role in the production of cardiac disease has long been suspected, and statements to this effect occur in the majority of text-books, usually unsupported by any pathological evidence. The truth of the matter is, that before the discovery of the Spirochete pallida as the etiological agent of syphilis, the pathologist himself recognized but few lesions of the heart as essentially pathognostic of syphilis. As to the significance of the gumma, he had no doubts; but gummas of the heart are relatively rare, hence his actual proof of cardiac syphilis became restricted to those instances in which the gumma was present. The frequent association of forms of chronic myocarditis, fibroid heart, anemic infarction of the myocardium and coronary sclerosis, with other pathological evidences of syphilis elsewhere in the body, such as tabes, paresis, gumma of the brain or liver, aortic aneurysm, bone lesions, orchitis fibrosa, etc., has given the pathologist a strong leaning to the view that the heart is one of the most frequently affected organs in syphilis. In my own experience this has been the case, and I consider the most frequent pathognostic lesion-complex of syphilis to be that shown by the heart, aorta, and the orchitis fibrosa syphilitica of the testes. To these, a fourth lesion could be added as next in constancy of occurrence, the presence in the adrenals of small areas of plasma-cell infiltration.

That these lesions are actually syphilitic could only be assumed upon the strength of circumstantial evidence before the demonstration of the Spirochete pallida gave us a positive finding by which the diagnosis of syphilis could be made absolute. The whole pathology of syphilis must then be worked over from the standpoint of this new criterion, and this is particularly true of the affections of the heart long supposed to be syphilitic, but which from their nature could not be positively determined to be so. From this point of view I have been for several years engaged in a study of cardiac syphilis based upon the occurrence of the Spirochete pallida in the tissues of the heart, and the results of this study, insofar as the primary tissue lesions of the heart muscle are concerned, I wish to give here in a condensed form.

The material studied consists of two hundred hearts, fifty of congenital syphilis and one hundred and fifty of acquired syphilis. They represent all ages and all stages of the disease; the congenital cases are mostly newborn and young children, the acquired cases mostly adults in middle life with a history of old infection. The number of active secondary stage cases in the adult is small, but sufficient to trace the development of the lesions through successive stages. The Levaditi method in its original form has been used chiefly in this work, as it still remains the most satisfactory method for the demonstration of the spirochete in sections. For the study

of the tissue changes themselves the ordinary staining methods have been employed, with resort to special stains for special purposes, whenever this was considered necessary to determine the nature of the lesion. As a result of this study the primary lesions of cardiac syphilis may be described as follows:

PARENCHYMATOUS. *Localizations of Spirochetes in the Myocardium without Recognizable Tissue Lesions.* Large colonies of spirochetes may be found in the myocardium, either in the tissue spaces of certain muscle areas, or about the bloodvessels, without any changes in the neighboring heart muscle that can be recognized by any of the technical methods employed at the present time. The muscle stains as well as normal heart muscle; it contains no vacuoles or granules, and presents all the appearances of normal muscle. The spirochetes lie in the intermuscular spaces, often in great numbers. Sometimes they appear within the muscle substance, as shown in cross-sections, but this is not common. Such findings are most frequent in congenital syphilis, but such collections of spirochetes without recognizable myocardial changes are found also in acquired syphilis, particularly in active secondary stages or early tertiary.

*Pale Degeneration of the Heart Muscle in Association with Spirochete Pallida.* One of the earliest recognizable changes in the heart muscle in areas containing spirochetes is the loss of color in the muscle fiber and its failure to take eosin in the normal way. Compared with normal areas, such affected muscle appears light and clear, with a loss of its striations, and shows vacuolated or light-staining nuclei. In the severe grades of this change the muscle passes so insensibly into the connective tissue that it is difficult to separate the two, so closely do they come to resemble each other in ordinary stained sections. Vacuoles may or may not be present in these fibers. The appearance of the fiber is not wholly like that of Zenker's necrosis, as it is less waxy or hyaline, appearing "washed-out." The fibers are also smaller than normal. This form of degeneration may occur as a purely parenchymatous change, but is most commonly associated with interstitial changes, particularly with the mucoid edema so frequently seen in congenital cases. This change is probably to be interpreted as being of the nature of a serous atrophy or liquefaction necrosis, but there is never any fraying-out of the cell protoplasm as in ordinary liquefaction necrosis.

*Fatty Degeneration.* A marked fatty degeneration of the cardiac muscle is often the only tissue lesion associated with the presence of the spirochete colonies in the myocardium. It occurs as a focal change, visible to the naked eye as yellowish pin-head spots, but often larger. Microscopically, the fibers are atrophic and filled with large droplets of fat, the droplets, as a rule, being larger than those commonly seen in fatty degeneration of the heart

muscle in such conditions as anemia, phosphorus poisoning, etc. Usually two or three large vacuoles replace the cytoplasm. This fatty degeneration of the fibers occurs also in the muscle surrounding the areas of interstitial infiltration and proliferation. In these areas of fatty degeneration, fewer spirochetes are usually found than in the focal areas of fatty degeneration unaccompanied by interstitial changes. In the case of severe vascular and perivascular infiltration and proliferation, irregular areas of fatty degeneration occur along the affected areas, but this is probably a secondary change to the circulatory disturbance. In the focal areas without other changes than the mere presence of the spirochetes, the occurrence of the fatty change must be explained as due to the presence of the organism, the latter probably robbing the tissues of their oxygen and food supply. Following the focal fatty degeneration, there may occur later a deposit of lime salts, so that focal areas of calcification can be produced by syphilis, and their occurrence in the myocardium should lead to a suspicion of this infection.

*Simple Atrophy.* Colonies of spirochetes can sometimes be located by the presence of focal areas of simple atrophy, the muscle showing no other change than a marked reduction in size. The interstitial substance may or may not be increased or show proliferation, and the pale degeneration and fatty degeneration may be associated with the atrophy.

*Necrosis.* In virulent cases of congenital syphilis in which the tissues of the body show enormous numbers of spirochetes, yellowish or light-colored areas may be found in the myocardium as well as in other parts of the body. These areas rarely exceed 5 mm. in diameter, and are usually much smaller. In the heart the muscle in these areas appears as fine fibrillæ without nuclei, or is entirely absent, its place being taken by a collection of lymphocytes, plasma cells, and fibroblastic cells. Around the borders fibers showing transition stages of liquefaction necrosis are seen, and the surrounding tissue appears as in a chronic edema, the tissue elements being pushed apart and the spaces filled with a fine albuminous precipitate, a mucoid substance and cells. With the specific mucin dyes, as kresyl violet, reactions for mucin are almost always obtained in these areas of liquefaction necrosis. Such changes are absolutely independent of any vascular changes, and are wholly the result of the spirochetes that lie packed in great numbers in these necrotic areas.

INTERSTITIAL CHANGES. *Edema.* In syphilitic hearts, particularly in congenital syphilis, pale areas, moist and translucent, may be seen even with the naked eye, or the entire heart wall may be very pale, translucent, and moist. On microscopic examination the pale foci are found to be areas in which the changes are wholly suggestive of edema. The muscle fibers are pushed apart, the reticulum is fibrillated and contains fine granules, and the number of wandering

cells is more or less increased. The presence of fat vacuoles in the muscle fibers adds to the general picture of a severe local edema, so that the average observer would pass it as an edema. But the Levaditi preparations show these apparently edematous areas to be filled with spirochetes, and the mucin tests show frequently the presence of a mucin-like substance, so that the edema is more of the nature of a myxedema. In these areas the spirochetes often appear closely applied to the capillary walls. Some of these areas are relatively poor in cells, but the majority show a fibroblastic proliferation, large, pale, epithelioid cells occurring, their cell bodies lightly staining, and their whole appearance washed out. Mononuclear white cells, plasma cells, and lymphocytes are present in varying numbers; and every transition exists between these pale, non-cellular, watery areas and those containing many cells.

*Interstitial Proliferation.* This may occur as the first recognizable tissue lesion, but usually after it has reached a certain point the parenchyma shows degenerative changes also. In the heart the proliferation appears to be always primarily vascular or perivascular, the endothelial cells of the capillaries proliferating and forming rods and groups of pale epithelioid cells, the capillary becoming thicker and thicker as the mass of cells in its walls increases. Now capillaries are produced and the area may come to be highly vascularized, but the new vessels are quickly obliterated by the proliferation of the wall. In the larger vessels, particularly in the arterioles, the proliferation is almost wholly perivascular and the spirochetes are found in great numbers in the perivascular lymphatics. Later these areas may become fibroid, and every possible transition stage is found between the focal edemas, and the areas of proliferation that may be interpreted as non-caseating gummas when sharply localized. In the congenital syphilis cases caseation of these areas must be very rare, as we have never found it. Such areas of proliferation without caseation exist also in acquired syphilis.

*Myxoma-like Areas.* A striking finding in the hearts of congenital syphilis is the occurrence of round, translucent areas that microscopically suggest myxomas and have been mistaken for such. With ordinary stains, hematoxylin and eosin, they appear as sharply circumscribed, spherical areas in which the heart muscle fibers have practically disappeared, only a few atrophic fibrillæ being left. A gelatinous tissue containing branching epithelioid cells and lymphocytes forms the main part of the area and new capillaries occur in it. Mucin tests show the presence of a large amount of mucin, so that the resemblance to a myxoma is greater still in preparations stained in this manner. Levaditi preparations show the presence of spirochetes in varying numbers in these areas, although the number is usually not so great as in the focal fatty areas and edemas. It is probable that the infection is a less viru-

lent and more sharply localized one. These areas may be regarded as young or undifferentiated gummas, myxogumma, without fibroid change or caseation, the tissue remaining in a fibroblastic semigelatinous state. The infiltration of lymphocytes and plasma cells is often very slight, so that this adds to the deceptive appearance of this formation, and if the Levaditi method for the demonstration of spirochetes were not carried out, the true nature of the process would not be detected.

CONCLUSIONS. These studies of cardiac syphilis would show that the primary lesions produced by the Spirochete pallida may be either parenchymatous or interstitial. The parenchymatous lesions are a peculiar pale degeneration, fatty degeneration, simple atrophy and necrosis; the interstitial lesions are the occurrence of a peculiar form of edema (myxedema), vascular and perivascular infiltration, and localized myxoma-like formations. The parenchymatous changes may occur absolutely independently of the interstitial, and the latter may be found with no associated changes in the neighboring heart muscle. The more marked the interstitial changes the more likely are parenchymatous changes to be associated with them, but the most marked parenchymatous lesions may occur without any interstitial changes. The purely parenchymatous lesions are found especially in virulent congenital and active secondary and early tertiary syphilis; in milder and older infections the interstitial changes, particularly the localized vascular and perivascular proliferations, predominate. The myxoma-like formations resembling undifferentiated gummas also occur in more localized and milder infections.

It is also of great importance to know that the heart is so frequently the seat of spirochete localization. The cardiac localization of spirochetes we have found to be more common than the hepatic. Spirochetes may be found in great numbers in the heart when no others can be found elsewhere in the body. In such cases the cardiac muscle may also show no lesions that, according to the older knowledge, would be classed as syphilitic, indeed, no organ or tissue may show any histological signs of syphilis even when the organisms are present in great numbers. That syphilis can produce purely parenchymatous lesions primarily in the myocardium opens up greatly the possibilities of this infection as a factor in the increasing myocardial affections of unknown origin. To what extent the Spirochete pallida is the etiological agent in these conditions cannot be estimated with certainty at the present time, but my own experience would make me believe that syphilis, both congenital and acquired, is the most important etiological factor in the production of cardiac disease, both myocardial and endocardial.

# THE MECHANISM OF PROSTATIC RETENTION.

By E. L. Keyes, Jr., M.D.,
CLINICAL PROFESSOR OF SURGERY IN CORNELL UNIVERSITY MEDICAL COLLEGE, NEW YORK.

Several studies have recently been published on the mechanism of prostatic retention, concluding with the statement that prostatic hypertrophy is not the cause of prostatic retention. Their inference is that prostatic hypertrophy may exist without retention, and that the true cause of retention is to be sought rather in the bladder muscle or innervation than at the bladder neck. They further support this theory with many reported cases of what the French call "prostatism without a prostate." together with Albarrin's theory of muscular weakness.

Two clinical types of prostatic retention may be distinguished: chronic, incomplete or complete retention, and acute complete retention. Though they are related, it is better to discuss their mechanism separately, beginning with the former, the chronic type, since the elucidation of this makes the interpretation of acute retention a matter of but a few words.

Chronic Prostatic Retention. Prostatic retention represents the interaction of two forces, the bladder muscle and the obstruction. The importance of each of these is best understood if they are discussed separately.

The Bladder Muscle. In discussing the action of the bladder muscle it is convenient to include the nervous mechanism that instigates the act of urination. We have, therefore, to note:

The condition of the muscle itself.

The condition of the nervous system.

The condition of the will.

*The Muscle Itself.* Suprapubic cystotomy on an old prostatic often reveals a bladder muscle that grossly resembles blotting-paper, and obviously possesses but little contractile force. Quite as often, however, one encounters a muscle with all the macroscopic and microscopic evidence of vitality. After prostatectomy upon these patients we find that the good or bad condition of the bladder muscle has little effect upon the ultimate result. The patient with the "blotting-paper" bladder is almost, if not quite, as likely to regain the power of emptying his bladder as the patient with the normal muscle.

I can recall many instances of complete cure after prostatectomy in spite of a "blotting-paper" bladder; nevertheless, these are a little more liable to incomplete relief by prostatectomy than are their brethern with more normal muscle.

For, supposing for the moment that obstruction at the bladder neck is an element of prostatic retention, it is evident that just

as a strong bladder may fight for a much longer time against an obstruction before it gives away; so, when the obstacle is removed, it must be more completely done away with to give entire relief to a sclerotic bladder than to a normal bladder.

Indeed, an experienced urologist can prophesy with a certain degree of accuracy that the patient with slight infection, and less than 100 c.c. retention, but undue urinary irritation and frequency, is likely to remain in this condition for a considerable time; while the patient who first comes to a physician after his bladder has silently reached chronic, complete retention with overflow will do badly. This prophecy is based in part upon differences in the tone of the bladder muscle. Furthermore, the progressive weakening of the bladder muscle doubtless is the main agency in the rapidity or slowness with which a patient passes through the first and second to the third stage of prostatic retention. Though here, again, the muscle is not the only element in the case.

*The Nervous System.* When the muscle of the bladder is seriously or completely paralyzed, as in tabes, the resulting retention is probably not solely due to weakness of the bladder muscle, for I have, by means of the Chetwood operation, satisfied myself that a diminution of the sphincteric obstacle at the bladder neck may result in considerable improvement in the symptoms of such patients.

As a striking example of this, let me cite the case of a patient, aged thirty-four years, operated upon in October, 1907, at which time he had been suffering from difficulty in urination for eight years, and for six weeks had been urinating every two hours, with incontinence both by day and by night. He showed a fairly constant residual urine of two ounces, denied syphilis, but had no patellar reflexes; his eyes reacted poorly, his prostate was normal, and he was sexually impotent. He had for a number of years suffered from lightning pains and paresthesia.

His convalescence after Chetwood operation was stormy on account of fulgurating pains, but he healed promptly. The fistula, however, reopened after two weeks, and did not close until December, 1907. Ataxia, which was not present before operation, gradually came on during the ensuing year, and now, six years after the operation, he is markedly ataxic, and speaks of himself as a broken man. Nevertheless, his urinary organs have given him absolutely no further discomfort. He urinates four times by day, not at all by night, and has no pain whatever with micturition.

A second tabetic, who had been ataxic for eight years, and used the catheter for seven: the residual urine varied from 100 c.c. to 500 c.c., and occasionally he had acute complete retention. The Chetwood operation revealed and divided a dense contracture.

His convalescence was also complicated by severe lightning pains. After operation he had complete retention for two weeks, and thereafter he learned that by holding his urine until the bladder contained at least 500 c.c. he could empty it down to 25 or 50 c.c. He continued in this condition until his death from pneumonia about eighteen months later.

This inability to urinate until the bladder is full I have found in a number of tabetics.

A third case, in acute complete retention, was unimproved in spite of two Chetwood operations by me, and several punch operations upon the bladder neck. A similar failure resulted from the cauterization of the neck of a paralysis following operation upon spina bifida.

The diversity of these results is due to the fact that a paralyzed bladder goes into a state of retention when there is even the slightest obstacle to urination at the bladder neck. Indeed, it is the paralyzed bladder that shows that curious combination of incontinence and retention not completely accounted for either by any large residual urine or a contracted bladder. In attempting the removal of this slight urethral obstacle to the emptying of the bladder, one is moved to great conservatism by the fear lest too bold an operation leave the patient more incontinent than before, and one is thus liable to remove only part of the obstruction in these cases where complete removal of the obstruction is most indicated.

*The Will.* The influence of the will upon retention of urine in typhoid and other wasting diesases was beautifully described by Dr. Samuel Alexander at the first session of the International Urological Congress. He ascribed retention in such cases to actual muscular weakness combined with weakness of the powers of attention. In some old prostatics I seem to have noted a similar unwillingness to take the trouble to empty the bladder. Quite recently an ancient Hebrew came into my service at Bellevue Hospital acutely overdistended, was relieved by suprapubic drainage, followed by prostatectomy under spinal anesthesia. His suprapubic wound healed within three weeks thereafter. Yet, to my great surprise, as soon as the fistula had healed he proved to have retention of urine, averaging about twenty ounces. The lowest amount we ever obtained was six ounces, the highest, forty-eight ounces. Yet his general condition remained excellent for the two or three weeks he remained in the hospital, and his family, who had apparently turned him over to us with high hopes that they might get his savings bank account, rather despaired of my ability to kill him, and so refused permission for any further operation. It is my impression that had the old man been moved by a real desire to empty his bladder he probably could have done so. Doubtless others have seen similar cases,

or at least they have seen that type of case in which after prostatectomy the patient habitually retains from two to four ounces of urine. If you inject into the bladder even a mild solution of potassium permanganate, or silver nitrate, this is emptied out to the last drop.

It seems fair, therefore, to state that the strength of the bladder muscle plays a large part in certain cases of prostatic retention; and that if muscular weakness is the predominant cause of retention, removal of the obstacle at the bladder neck, which is the occasion of the retention, is a more delicate matter than when the bladder muscle has retained its strength.

THE ENLARGED PROSTATE. Let us repeat once more, with Sir Henry Thompson and his followers, that not more than half of the men whose prostates are enlarged suffer from prostatic retention, and let us add that some of those who suffer from prostatic retention have no hypertrophy of the prostate. These are the two facts which, as we said in the first place, impress those who deny that enlargement of the prostate has anything to do with retention of urine. If they will modify their claim and state that the size of the prostate has no bearing upon the amount of residual urine, we agree with them most heartily, but beyond this we cannot go. It is quite obvious that in most instances prostatic retention is due to hypertrophy of the prostate, and it is equally obvious that in most instances the removal by prostatectomy of the hypertrophied portions of the prostate relieves the prostatic retention. But in certain instances this is not the case. There are those who have no prostatic hypertrophy, and to whom, therefore, prostatectomy is not applicable, there are those upon whom prostatectomy has been done without any influence upon their retention of urine, and (let us not forget) there are not a few upon whom a Bottini operation or a shockingly incomplete prostatectomy results in a cure.

These cases require explanation, and lead us to investigate more particularly the changes at the bladder neck associated with the various pathological conditions that excite prostatic retention. Before passing to these, let us state, briefly and categorically, our views as to the role of prostatic hypertrophy in prostatic retention:

1. The mere fact of hypertrophy of the prostate is not of itself sufficient cause for prostatic retention.

2. In order to cause prostatic retention, prostatic hypertrophy must interfere with the outflow of urine from the bladder.

3. This interference may be due to deformity of the bladder neck (of which we shall speak in a moment) or to an actual compression of the urethra within the hypertrophied gland.

4. That this compression, or stricturing, of the urethra cannot usually be an important factor, is evident from several points of

view: In the first place, the urethra is not strictured but rather dilated, as a rule. In the second place, there is usually no obstruction whatever to the passage of a catheter through the prostatic urethra from the time it leaves the membranous urethra to the time it reaches the bladder neck. A canal that transmits an instrument so readily would scarcely offer any resistance to the passage of urine, however weak the bladder.

5. Hence, we are forced to the conclusion that even the lateral compression of greatly enlarged lateral prostatic lobes, probably has little or no effect in interfering with the outflow of urine.

We might note the fact that the occasional success of the Bottini operation in relieving retention due to considerable prostatic hypertrophy is evidence confirmatory of this opinion. We pass, therefore, to consider the nature of the obstacle at the bladder neck.

THE BLADDER NECK. In order to simplify the somewhat complex problem presented by the obstacle of urination at the bladder neck in a case of prostatic retention, let us at the outset exclude from consideration such unusual conditions as hypertrophy of the anterior lobe, or enormous hypertrophy of the middle lobe, or other eccentric growths, since these produce a mechanical obstacle rather different in its nature from that which we usually encounter.

We therefore confine our observations to the usual types of obstruction, which may be classified under the following heads:

1. Middle lobe hypertrophy, more or less pedunculated.
2. Lateral lobe hypertrophy, without a clinically recognizable middle lobe.
3. General hypertrophy, in which neither lateral or middle lobe are prominent.
4. General hypertrophy, in which middle or lateral lobes, or both, are prominent.
5. Contracted bladder neck.

It would obviously be quite impracticable, and happily it seems quite unnecessary, to consider the mechanical obstacle to urination, caused by these different pathological conditions *seriatim*. The obstacle is much the same whatever the cause. In order to appreciate its nature let us first compare the observations made by the examining finger when introduced through the perineum into the prostatic urethra of the normal case and the case in prostatic retention. Let us suppose, in the first place, a patient with stricture of the bulbous urethra that has been divided by perineal section. The finger is introduced into this wound, passes through the membranous urethra, usually tearing this somewhat, thence into the prostatic urethra, which is identified as a somewhat dilated portion of the canal that readily admits the finger, and thence into the normal bladder neck, recognizable as an elastic muscular ring, beyond which the tip of the finger may be pushed into the emptiness of the bladder cavity.

Palpation of this muscular ring reveals that it is not prominent upon the roof of the urethra, while it grows more prominent as it approaches the floor. Thus the finger lying in the urethra with its tip against the bladder neck pushes against that part of the ring which even in the normal state rises up to make a slight muscular bar between the floor of the urethra and the floor of the bladder. In prostatic retention this obstruction to the entrance of the finger into the bladder is much more marked. As the finger passes through the prostatic urethra it may encounter and note the presence of prostatic lobes projecting into the canal laterally, or from below, and at the bladder neck, but it also recognizes that the chief obstacle is at the neck of the bladder whether this obstacle be due to prostatic hypertrophy in the form of a middle lobe, or bar, or to sclerosis, in the form of a contracted bladder neck. Indeed, it recognizes that when the bladder neck is tightly contracted, this contraction occurs almost entirely at the expense of the floor, while if only the lateral lobes of the prostate are enlarged the obstacle to the entrance of the finger into the bladder is a veil or bar of bladder neck lifted up between these lateral lobes.

The same observation may be made if these various pathological conditions are examined from a suprapubic opening into the bladder. Whether there be a general "horse-collar" hypertrophy, a contracture, a lateral hypertrophy, or a middle lobe, the finger introduced into the posterior urethra recognizes that between it and the bladder, on the floor of the urethra, there is elevated an abnormal obstruction. This obstruction is the mechanical cause of prostatic retention. It arises from the floor and not from the roof, even in cases of contracture and of lateral prostatic hypertrophy, because the roof of the urethra is more fixed (by the puboprostatic ligaments) than is the floor.

The precise way in which this obstacle interferes with the outflow of urine from the bladder has never been absolutely proved. Unquestionably, it prevents the normal opening of the internal sphincter, thus causing the difficulty in starting the urinary stream. But why does it in so many cases reduce the bladder to a condition of partial retention in which the amount of residual urine is practically constant whether the patient stands upon his head or upon his feet? The explanation of the phenomenon is suggested by the fact that if a bubble of air is injected into the normal bladder this always issues after the last drop of urine is passed. In other words, the bubble floating on top of the urine under the vault of the bladder is the last thing to issue from the bladder in a normal urinary act. Moreover, if the bladder contains thick, tenacious pus delivered from a pyonephrosis, and lying upon its base, this pus will issue at the end of the urinary stream, and immediately ahead of the bubble of air which closes the stream.

If there is retention of urine neither the pus at the bottom of the bladder nor the air at its vault are extruded.

To explain these phenomena we must assume that as the bladder empties itself the trigone is somewhat elevated, forming the flare of the funnel, which in a normal bladder begins in the prostatic urethra, and the remainder of the bladder closes down upon this funnel, the lowest and highest points in the bladder cavity lying posterior to the trigone and being emptied last. But when there is retention the funnel is an inadequate one, the bladder neck fails to open as it should, and the result of the effort to squeeze out the last drops of urine is to close the bladder neck. The closure should be interpreted not as a sphincteric gripping, but as the driving of the prominent lower lip of the bladder neck against the upper wall of the prostatic urethra. If the closure were sphincteric a hard push might force it and drive out a few drops more of urine, but inasmuch as it is rather the application in the form of a valve of the prominent lower portion of the sphincter against its upper portion, the harder the patient strains the tighter does the valve close. The only way he can pass any more urine is by relaxing his muscles and permitting the sphincter to open a little. Then another effort may bring forth quite a flow of urine before the valve flaps shut again.

Acute Complete Retention. Chronic retention is due fundamentally to an inability of the bladder sphincter to open until the bladder is partially full. Acute complete retention is due to a congestion and spasm at the bladder neck of such intensity as to apply the posterior lip of the sphincter against the anterior even when the bladder is full. Operation upon such a case does not reveal an impassible closure of the neck of the bladder, as would be the case were the obstacle a sphincteric or stricture-like one, and not a valve-like one.

The mechanism of acute complete retention, is, of course, the same in prostatic abscess as in prostatic hypertrophy.

One readily understands without further comment how various combinations of obstruction, congestion and spasm produce the many variations in the clinical phenomena of prostatic retention, while the gradual progress of the increase in the amount of retention of the urine as the months go by is due largely to gradual decrease in the strength of the bladder muscle.

Practical Deductions. Several practical conclusions may be drawn from the above remarks. In the first place, since mere prostatic hypertrophy is not enough to cause prostatic retention, prostatic retention may sometimes be relieved by removal of the obstacle at the bladder neck without any attention to the prostate, even when this is hypertrophied. This the Bottini operation used to do blindly, and, as it were, accidentally, while the Chetwood

operation achieves it intentionally. I have several times relieved the retention, great or small, of a patient whose prostate showed bilateral enlargement, simply by dividing with the Chetwood instrument the bar at the neck of the bladder, while paying no attention to the enlarged lateral lobes. The same thing can sometimes be done when the median lobe of the prostate is hypertrophied, when it is in the form of a bar or a pedunculated lobe, though it is obviously safer under these circumstances to remove the bar or lobe. But the point illustrated by the success of the Chetwood operation is that an attack directed solely upon the bladder neck at its lowermost part can relieve prostatic retention. Yet when the prostate is considerably enlarged it were obviously futile to satisfy one's self with division or excision of the bar or middle lobe, for then the lateral masses at the bladder neck crowd in and still interfere materially with the opening of this orifice. Indeed, whatever the condition of the bladder muscle at the time of operation we can count upon this growing weaker as the years elapse. Hence our ambition should be to remove all possible obstacles to urination, including all hypertrophied portions of the gland.

But it cannot be too often repeated, the prostatectomy, the removal of the hypertrophied portions of the prostate gland must be looked upon only as a means to an end, that end being the removal of the obstacle at the bladder neck. Hence the technical disadvantage of perineal prostatectomy, especially for the neophyte who is likely to be satisfied with removal of the more immediately presenting portions of the hypertrophied prostate, while totally disregarding the obstructing bladder neck that lies beyond. Hence, also, the mechanical superiority of suprapubic prostatectomy, since the attack from above inevitably at least tears open the neck of the bladder, while this is the last region reached from below.

It has been our experience that no operation for prostatic hypertrophy will give 100 per cent. of cures among the survivors, for the peculiarities of healing after operation and the weakness of the bladder muscle may well frustrate our most intelligent efforts. Yet, in conclusion, we should like to insist in theory as we always have in practice that the problem of prostatic retention is a mechanical problem; that the bladder neck, and especially the elevation of its inferior lip, is the important mechanical obstruction, and that prostatectomy, suprapubic or perineal, total, subtotal, or partial, should be performed with the object of obliterating this obstacle at the bladder neck.

# HYPERTENSION: A REPORT OF CASES UNDER PROLONGED OBSERVATION, AND A PROTEST AGAINST SOME IDEAS.

By M. J. Lichty, M.D.,

ASSISTANT CLINICAL PROFESSOR OF MEDICINE IN THE WESTERN RESERVE UNIVERSITY, CLEVELAND, OHIO.

Hypertension is such a significant condition, that anyone who studies many cases should perhaps be permitted to express his personal impressions and experiences. Though it is not many years since much attention has been given to it, in the course of routine physical examination, it is surprising at present to see how frequently one meets intelligent patients, who have some information about the annoying condition. Frequently they presume to understand its significance and it alarms them, perhaps unnecessarily.

Before entering into any discussion of the subject, I wish to report some cases:

Case I.—A patient, now aged fifty-four years, has been under close observation for the past seven years. He is the father of three healthy children. His previous history and habits are excellent. He is a prosperous manufacturer, and his business of recent years has simply driven him incessantly. When first seen he was complaining only of constipation, insomnia, a feeling of nervousness, restlessness, and pain in the calves of his legs, which annoyed him most at night or when away from his office. He loved good food and always had it. When first seen the physical examination was almost negative; abdominal and thoracic organs and nervous system normal also. Though he had a marked gastric hyperacidity, rather firm and full arteries, and a blood-pressure of 200. During these years of observation his systolic blood-pressure in the arm has varied from 160 to 230. Some of the latest observations of the tension, as established both by palpation and auscultation, showed a systolic pressure of 215 in the arm and 265 in the leg. There was possibly the same difference in the diastolic pressure, inasmuch as the carotids seemed to empty more completely during the diastole than did the femoral.

While this patient's urine is usually normal, it has often contained a trace of albumin and some casts. Bile and indican are frequently found. His liver is sore occasionally and slightly enlarged. And at those times one may find fault with the heart, either dilatation or hypertrophy with dilatation.

Now, in spite of any skepticism which physicians and post-mortem pathologists might have concerning diagnosis, I believe the patient has a beginning interstitial nephritis; some sclerosis

of the arteries, but so far little hypertrophy of the heart. The patient has always been rather apprehensive and introspective and worried about his blood-pressure and expectation of life. Though he has but few symptoms at present, he is much disappointed on account of inability to buy life insurance. To be restricted in diet and greatly deprived of meat becomes irksome to him. But a seven year's course of treatment has made its impression upon both patient and physician.

Moderate doses of nitroglycerin or any vasodilators cause violent headaches, and do not reduce the blood-pressure. Frequent hot baths followed by a slight sweat between blankets are effectual for comfort, though the pressure remains up. The occasional Turkish bath has the same influence. Treatment with the high-frequency electric current has been used faithfully without any reduction in blood-pressure. A few years ago the patient was kept in bed four weeks, and confined to his home several weeks longer, mainly to insure rest and isolation from the annoyance of a labor strike by hundreds of workmen in his firm's employ. At the same time he was having a strict diet and some medical treatment as well as hydrotherapy. This treatment made him feel better, but did not have any marked effect upon the blood-pressure.

His main line of treatment has been for the relief of constipation, by some exercise, suitable food, and much water. He had used cholagogues almost continuously. When deprived of these he does not feel well. Effectual medicines have been calomel, rhubarb, soda, magnesia, and Carlsbad powder; and when small doses of bromides are used, the effect is still more pleasant. Iodides have been taken faithfully at frequent periods for months, but with questionable advantages. While using salicylates and urotropin the urine usually contains less bile and indican, and the patient feels more comfortable. While this patient's blood-pressure has not been influenced much in seven years, he is, after all, comparatively free from symptoms when he pays constant attention to elimination. And in spite of a high pressure, which ought to concern anyone, he has been active in business. He cannot learn to be lazy, and now the question arises whether further attempt should be made to lower the pressure.

Case II.—This case was first seen in 1906. The patient appeared at my office with a quart of whisky under his arm and a pipe in his mouth. He was aged eighty years, and sought relief from a slight skin affection and a stiff knee. He was never sick in bed. The physical examination was negative, except for arteriosclerosis, hypertension, and bile and indican in the urine. In April, 1911, he had an attack of pyelocystitis after his return to the city from New York, where he usually spent the winter, and where he also used more stimulants than elsewhere on account of his dislike for the water-supply of New York. He has abstained entirely

from the use of whisky ever since this attack of cystitis, though it was somewhat of a hardship at first, having been accustomed to take one or two quarts of whisky and sometimes more each week for the past forty years. When asked when he first began to use liquor, he said (with a clear mind) that he supposed about the time he could hold a bottle to his mouth. In May, 1912, he had a mild apoplexy and a partial paralysis of the right side. While the blood-pressure was over 200, it fell to 130 at the end of four weeks, with rest in bed, but returned to the former point soon after he began to move about again. While in bed he was treated with cathartics, hot packs, bromides, and small doses of iodides and nitroglycerin. As the nitroglycerin in more than one-drop doses every hour caused much headache, he refused the medicine. The iodides received the same condemnation. Now, in spite of prolonged alcoholism, arteriosclerosis, paralysis, and hypertension, there is no marked heart or kidney lesion. And one might wonder whether such a patient might not live indefinitely if he had begun to use iododes and various forms of buttermilk at about the age of forty to prevent high blood-pressure. It must be stated that the patient, now eighty-seven years old, has always lived in comfortable circumstances, provided by his own industry. He is not rich, but far from poor. He does not worry. When eating, he is abstemious and deliberate. His wife once told me that "Henry was never known to be in a hurry."

CASE III.—A man, now aged fifty-eight years, has been under observation for five years. He has been active and successful in business. Never idle a minute. He abstained from alcohol and tobacco, and excepting an attack of cholecystitis, he was never sick. He complained of constipation, dyspnea, insomnia, "lame all over." He had firm arteries, a blood-pressure of 185, hypertrophy of the heart, and a big liver. The urine was negative, except for bile and indican. In 1909 the blood-pressure was 190. In 1910 he had considerable dyspnea and cough, and thought he was catching cold too easily. In spite of emphatic advice to take a rest or prolonged vacation, he stuck to work. In February, 1911, there was more dyspnea and another supposed laryngeal cold, which caused aphonia before he saw a physician. The blood-pressure then was 200, and physical examination and the *x*-rays showed much cardiac hypertrophy and enlargement of the aortic arch. There was paralysis of the left vocal cord. Aneurism seemed certain and the prognosis bad. He was treated by absolute rest, scant foods and drink, and hot tub baths and mild sweats almost daily. Small doses of iodides were used for many weeks, and nitroglycerin in one to ten-drop doses every hour were tolerated for days at a time, and seemed very beneficial. On account of constipation, bile and indican, and sometimes albuminuria with casts, alkalies were used constantly and freely. Vichy, magnesia,

Carlsbad powder, soda bicarbonate and vegetable cholagogues, urotropin and salicylates were used at times. Bromides and small doses of chloral were taken frequently with much advantage. The blood-pressure gradually dropped to 150 and later to 130. After twelve weeks' rest in bed his voice began to return and the *x*-rays showed a much smaller heart and aortic arch. Since that time the patient has been watched closely. He has almost retired from business, has travelled some for pleasure, and visited the European spas. He feels fine; the heart is not much enlarged, though the urine contains bile too constantly, and some albumin and casts quite frequently, and the blood-pressure varies between 160 and 200. In this case, therefore, while the blood-pressure still remains high, most of the annoying symptoms have disappeared, and of undoubted and perhaps equal value have been the medication, absolute rest, diet, hydrotherapy, and withdrawal from business activity.

CASE IV.—The patient is aged sixty-six years, and has been under observation for four years. He is a financier, manufacturer, and employs men by the hundreds. He has always lived well, not alcoholic, but not an abstainer. His maximum weight was 265 pounds, five years before. Four years ago his weight was 165 pounds, at present 218 pounds. He was never sick in bed, but gave an indefinite history of a chancre at the age of forty-eight. There were no secondaries. He had been somewhat icteric for some years, and was annoyed with dyspnea, headache, insomnia, and weakness; could hardly walk a block, and thought he would soon be in a wheel-chair. He had positive signs of tabes, though the Wassermann test of the blood was negative. The arteries were firm, and there was marked hypertrophy of the heart. The liver shows enlargement at most of the examinations, and he is always tender over the gall-bladder.

The urine occasionally shows bile or a trace of albumin or a few casts. He has been treated by injections of mercury to the point of toleration. The injections were given twice a week for periods of two months, with four-month intervals. I could never see that he was benefited by the constant use of iodides. The nitroglycerin and tetranitrate in very small doses, taken three times a day are almost intolerable. A strict diet, the routine use of alkalies, cholagogues, and frequently a five-grain pill of blue mass, together with hot baths, light massage, and some exercises, have given the patient much relief. He is stronger and can walk quite easily. The heart is smaller, but the liver is still palpable. The systolic blood-pressure has varied from 150 to 210. No doubt mercury is the remedy which in his case has been most beneficial, but of unquestionable value were the alkalies. In this case the failure to reduce the blood-pressure is perhaps not so serious a matter as one might think.

CASE V.—A housewife, now aged seventy-five years, has been closely observed for four years. She was never seriously ill, and complained only of dyspnea and a cough (bronchitis, she said), which annoyed her for several years previously. She also complained of indigestion and constipation. Her liver was enlarged, and there was tenderness over the gall-bladder. Her weight was 160 pounds. There was hypertrophy of the heart, but compensation was fairly good. The arteries were full and firm, and the blood-pressure 198. Several times during the last four years she has had attacks of pain over the heart and stomach, simulating angina pectoris, though they were more common at night. But as some of the more recent severe attacks of pain have been observed more closely, I am convinced that the patient is more likely to have a chronic disease of the gall-bladder. Bile is frequently found in her urine, sometimes considerable albumin, with a few casts, and at other times 1 to 3 per cent. of sugar. The quantity and specific gravity of the urine are usually normal. Her blood-pressure, taken frequently and under various conditions, has varied from 145 to 210 and more. When she follows most faithfully the advice about diet, drink, and excercise she usually shows a lower pressure. But a high pressure and associated symptoms are just as positive when the patient is under nervous strain, such as has been observed when there was sickness in the family or even disappointments in the affairs of her home, which is her pride. But the patient has been faithful to advice and treatment, and in spite of continued hypertension, she says she feels much better than she did some years ago. She has taken iodides and nitrites repeatedly in such small doses as she could tolerate, but excepting a few occasions it is doubtful whether such remedies have been of any value. Remedies which have been found most helpful are cathartics, cholagogues, alkalies, bromides, and digitalis, together with hydrotherapy. And though medical treatment has been of some value, it is not improbable that this patient has an underlying surgical condition of the gall-bladder.

CASE VI.—This case is that of a man under close observation for three years prior to his death, at the age of fifty-four years. Though the time of observation was but a short time ago, the patient's condition and struggle for existence deserve some report. He was a mechanical engineer, and had unusual ingenuity and business capacity. Though in comfortable financial circumstances, he possibly accumulated more wealth for others than himself. When first seen he said he had never been sick. There was no history of venereal disease nor alcoholism, and he did not smoke. Some years before he was confined to bed a few months on account of a broken leg and arm. He complained only of being weak, tiring easily, and lacking former ambition. He said he had some dyspnea, headache, and distress after meals. His

blood-pressure in the arm was 230. The pulse was firm and a little irregular, and the heart considerably hypertrophied toward the left and also to the right. The liver was palpable, the gastric contents normal, and the urine contained only a trace of albumin. Repeated examinations of his urine were made from first to last, and the findings were about as follows: Twenty-four hour quantity and specific gravity normal; occasionally a trace of albumin and a few casts were found (sometimes many casts and no albumin), but more frequently bile and indican were present. He was at once put under rather strict regimen, partaking of scant non-nitrogenous diet; a medical treatment was outlined, and there was some relaxation in his business. At the end of the first six months' treatment he said he was much more comfortable. Some of his annoying symptoms had almost disappeared. His heart showed less hypertrophy, and the liver was no longer palpable, though the blood-pressure did not drop below 200. Then in an improved condition of health, he plunged into business again when competition was most keen. He secured business orders amounting to several million dollars, sufficient to keep a large plant busy for two years in advance. And though he won his laurels, he paid a dear penalty for such intense application. Emerson's maxim that "everything costs" is true in health as well as in finance. His former symptoms became more annoying than ever, and the blood-pressure returned to 225 and more. He found it almost impossible to partake of nitrites and iodides even in small doses. They caused unpleasant symptoms and intense headaches. However, careful dieting, hot baths and the bromides, and saline and mercurial cathartics gave some relief and comfort. He was finally persuaded after eighteen months to get away from his business for a long vacation, something which he had not taken for the previous eleven years. He spent a winter at the seacoast, and in addition to medical treatment he took a prolonged course of treatment with electricity, the high-frequency current. Before going to the coast his blood-pressure ranged form 225 to 250, but dropped to 200 soon after a little rest there.

The physician applying the electricity reported favorably at first, stating that he soon found the pressure as low as 175, and daily treatments reduced it to 155 and 160. But when the patient returned to the city to meet a business appointment, after a few months' treatment with electricity, I found the pressure as high as 235; so he returned to the coast for the remainder of the winter, but he failed to show any improvement for some time. Early in the spring he attempted to resume some work without seeking further medical advice, but a severe nose-bleed in his office and at his home brought him under observation again. Then after much disappointment and great anxiety about business again,

I found him intensely weak, dyspneic, without appetite, and unable to sleep. The pressure then went to 240 and 260. The heart was larger than ever, and there was a marked aortitis and dilation of the aortic arch, a condition confirmed by able consultants and *x*-ray examination. From that time until five months later, when he died, he was treated by diet, packs, iodides, vasodilators, cathartics, sedatives (in insufficient quantity perhpas), and digitalis at times. Frequent venesection gave some relief for a few days, though the patient several times became delirious, even almost maniacal for several days after the withdrawal of twelve ounces of blood, and the blood-pressure would not remain below 200 for more than a few days.

He became more restless than ever and made a desperate struggle for a recovery which he thought ought to come soon and completely. But attacks of angina pectoris developed and continued to the end. It should be added that this patient, respected by everyone, was of such a temperament that he was his own worst enemy. He was an indefatigable worker, and though kind to everyone, he was irritable under heavy pressure. He could not undertake anything without throwing the last spark of energy into it. He could not surrender to ideas differing form his own without positive conviction. Any subordinates in his employ or any members of his household who failed to meet his expectation were a source of worry and disappointment.

Hypertension and constitutional disease resulting in death should not be surprising when one considers such a nervous disposition and constant application through eleven years without a vacation.

Discussion. The literature on hypertension is now becoming voluminous, but opinions expressed by thoughtful and capable men are so much at variance that one is perhaps excusable for doubting a great deal that is said. Much that is written may be classified and placed under one of three subdivisions:

1. Under the first is seen the experimental, largely technical and almost ultrascientific work, though even this is not free from the theoretical.

2. In the second is much report of practical experience, though combined with empiricism.

3. Under the third are dogmatic statements, interesting but of questionable significance.

Up to the present men are no more of the same opinion about hypertension than they were years ago in the study of other pathological conditions. Not many years ago a diseased ovary was almost routinely and perhaps often unwisely subjected to operation; appendicitis was a subject causing vicious argument and bitter criticism; and many recognized heart lesions were either favored or hampered by aconite or digitalis. So at

present many opinions about the etiology, prognosis, and treatment of hypertension are not conclusive either. Too frequently the mere mention of hypertension is considered a sequel of alcoholism or syphilis, and is coupled with the name of some drug considered a vasodilator and a specific remedy. But not until one knows that vasodilators are no more of a specific in hypertension than is digitalis in all forms of heart lesions, can he appreciate the cause of failure to restore the abnormal condition. A specific treatment is out of the question where a specific cause is unknown. And the supposed causes of hypertension are about as numerous as the causes of headache, likewise the prognosis is about as uncertain as life itself. And the methods of treatment are, and perhaps should be, widely different. How frequent are disappointments after the routine use of iodides and nitroglycerin. And how disappointing are the many brands of buttermilk for the prevention of senility. The elixir of life and perpetual youth is still a fable in spite of remarkable statements.

Etiology. Though pathologists agree on postmortem tissue changes, they after all see that different lesions in different organs produce a common group of symptoms with an equal amount of tension. And though there is much agreement about the pathology, there is a contrasting disagreement about the etiology, prognosis, and treatment. In spite of the opinion that some toxin circulating in the blood causes first a contraction and later pathological changes in the vessels to produce hypertension, no such specific poison or poisons have been recognized. Opinions expressed about the probable nature and source of such a toxin are many, and the failure to find it is a disappointment. But the same is true of many other afflictions. However, as the effect of certain known poisons, such as metals, when introduced into the system, is unquestionable, some conjecture about the effect of indefinite poisons developing within through the imperfect functions of various organs must be permitted. The toxic symptoms caused by bad hygiene, disorder of the ductless glands, as well as the disturbed function of the kidneys, heart, and entire digestive system, are so positive, that none can fail to recognize them. Indeed, such a failure is inexcusable. Of course, there is no plausible explanation known at present why the toxins caused by disease of these various organs produce hypertension in some patients and not in others. But such is the case. In thyroid disease we have a striking example. The low pressure found in that condition is very common and not surprising, but it may also be very high. A patient with alarming symptoms of hyperthyroidism, even of suffocation from the pressure of a large gland demanding immediate operation, has been under observation for several years, and has had hypertension both before and since his thyroidectomy.

To recognize any abnormality of the blood is imperative, and a positive knowledge of elimination from the bowels and skin is most essential. To examine urine for sugar and albumin without regard for the presence of other poisons as bile and indican, and the microscopic findings, as well as for the twenty-four-hour quantity, is equally inexcusable. Nor should the influence of the infectious diseases, syphilis and other venereal diseases, be overlooked. Though perhaps fully as important as anything else is the influence of the nervous system upon hypertension. Many of these patients live and work under such great mental strain and nervous tension that, if it could be measured, it would probably even surpass the arterial tension. Consequently, while there is much conjecture about the etiology, it must be emphasized that any failure to search for the most probable cause of hypertension as well as a disregard for the associated symptoms and physical signs, makes the treatment of the condition much less irrational.

PROGNOSIS. While the prognosis in any case of hypertension may be difficult, it is frequently demanded. Surely no statement should be made to patients without great caution and due appreciation of all annoying symptoms. To presume that the condition becomes the more serious as the tension is higher is a common error. And whether the tension be moderately or extremely high and whether the associated symptoms be mild or severe, a hopeful outlook, except in rare instances, is the only one to give a patient. Numerous cases similar to the ones above reported convince me that when prognosis is based on the following conditions it is very frequently correct.

1. Where hypertension exists with but little or no recognizable disturbed function of other organs the outlook is the most favorable.

2. Where it is associated with marked disturbance of any one other organ alone it is more serious.

3. Where it is associated with great defect of several other organs, such as kidney insufficiency, cardiac insufficiency, cirrhosis of the liver, and lesions of the gastro-intestinal tract, the prognosis is most serious.

4. When the hypertension is associated with symptoms and physical signs which disappear after a more or less active and prolonged treatment, which, however, fails to lower the tension, a favorable prognosis is not unwarranted. Such cases are rather frequent, and I believe it is just as unreasonable to take an unfavorable view of them as it is to predict a speedy fatality in all cases of pulmonary tuberculosis where the bacilli are found in the sputum.

5. When the tension is found in connection with changes in organs producing such extreme symptoms as dropsy, ascites, cyanosis, and orthopnea, and when these symptoms cannot be relieved whether the tension is modified or not modified by heroic

treatment covering five to eight weeks, then defeat is sure. And the extraordinary measures, such as drastic purging, venesection, and medication, with excessive doses, are entirely useless, or effectual only for a short time, and sometimes more cruel than humane.

Thus two patients with hypertension the result of cardiac, vascular, and renal disease were under observation at the same time in St. Luke's Hospital. Both had much dyspnea and dropsy; one patient also had ascites and a big liver.

After several weeks of active treatment in a futile effort to restore health, these patients, though considered incurable when first seen, were relieved of much dropsy, and the blood-pressure was lowered to points between 140 and 160. One morning both patients were found weak and extremely delirious, possibly on account of cerebral anemia, the result of a relatively lower blood-pressure in the head than in the extremities. They were given more food and some stimulants or tonics, and their dilirium disappeared in a few days. One died suddenly of angina pectoris after a few weeks, and the other of cardiac insufficiency several months later.

The belief that there are different degrees of tonus in the different parts of the body was first mentioned by Hoover a few years ago. No doubt a more general recognition of this condition, whether made by the hand of the examiner or by the instrument, would be helpful in the treatment.

TREATMENT. A lengthy discussion of the treatment of hypertension is not the aim. Though the success or failure to modify the blood-pressure in the six cases here presented, to which a report of great numbers could be added, is quite convincing that no routine method can be followed. The too frequent use of the sphygmomanometer, with a report of the pressure, is bad policy and positively harmful to many anxious patients. A little diplomacy or an evasive answer, with the assurance that it does not matter particularly, is good psychotherapy. Now, while the literature contains many good suggestions, it also contains many that are worthless. But this is sure, where it is impossible to prevent the accumulation of toxins there must be constant elimination either through the organs of excretion or by withdrawal of a part of the blood containing them, or they must be made more harmless with some form of medication. Elimination through the skin, kidneys, and bowels is a common procedure, the methods differing only according to individual opinions. Removal of the cause is, of course, old advice and essential. Where there is an underlying specific disease, which can be met by specific treatment, any other treatment is of secondary consideration.

Since Fischer, of Cincinnati, and others have studied the influence of alkalies upon the blood and the kidneys, I have used

the remedies much and with undoubted advantage. Even before that time I was impressed with the benefit derived from the alkalies prescribed for many cases of hypertension in whom there was an impaired function of the kidneys, liver, and bowels, and especially in many cases of gastric hyperacidity. Of course, various methods and medicines have their adherents, and it is not the intention to underestimate the value of vasodilators, iodides, and alteratives, and even various tonics, which have their place according to indications. Rolleston has reported much benefit from the use of urotropin, salicylates, and vaccines for the toxemia of digestive disturbances. He reports especially good results in those cases of chronic disease of the gall-bladder, which either do not require or do not submit to operation, as well as in cases which have not been cured by operation. Chronic toxemia and subsequent hypertension following prolonged disease of the gall-bladder, appendix, or general digestive system may be hard to believe, but fully as hard to deny. And though the term "gastro-intestinal auto-intoxication" may be vague, it must not be forgotten. The value of frequent venesection and perhpas even the emetics used in former years is not sufficiently appreciated. The administration of thyroid extract has only been disappointing, and the high frequency current of electricity is far from giving general satisfaction. Sedatives, such as asafetida, bromides, small doses of veronal, chloretone, chloral, and even codeine, combined with phenacetin, have been of greatest benefit; and while sedatives must be used with caution it is not always best to withhold them absolutely or too long in desperate cases. Anyone will be impressed with the change in pulse and lowered tension produced through the night by the administration of a cathartic and a small dose of opium or an equally small hypodermic of morphine.

Diet, of course, is no less important than medication, but so often foolishly restricted; and while overfeeding must be prohibited, a diet of buttermilk is not a specific nor sufficient for prolonged treatment. Personal habits must be faultless. Rest, exercise, and hygiene must be carefully directed and respected. A partial and sometimes entire withdrawal from business, or a radical change of occupation as well as change of environment and climate, all may be necessary. Domestic infelicity is a serious barrier to successful treatment. Any nervous strain from overwork and from worry, so often needless, must be relieved.

While hardening of the arteries and high blood-pressure are not necessarily coincident with advancing years nor the index of senility, so commonly supposed, the association of high vascular tension and great nerve tension is a common observation. Accumulation of wealth is often at the expense of health. "Better a handful with quietness than both hands full with travail and

vexation of spirit," is good philosophy for health and prevention of disease. Though it is hardly safe to presume that there is a relatively low blood-pressure in the wealthy indolent, the so-called nobility, nor even in the individual of leisure enfranchised by the War of the Rebellion.

A reputation for laziness would be considered as infamous slander by five of the cases herein reported. Only the one who was never known to hurry has the assurance of extreme age.

A report of most excellent health in these patients is often followed by sudden exertion or haste resulting in sudden apoplexy or death. The patients who cannot realize the wisdom of deliberation are numerous and hard to manage. For many of these there is some relaxation in books such as the story of *Napoleon Jackson*, the negro, likewise some of the works of Mark Twain, and *Adventures in Contentment and Friendship*, by Grayson. Such recommendation of books has been followed by good reports not attained by medicine.

And happy is the patient who has secured mental peace through such philosophy as Bryant has put into the last paragraph of "Thanatopsis;" but pitiable is the other patient, who, fearing the end of life and apprehensive of sudden death, is miserable to the last moment.

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## THE ELECTROCARDIOGRAPH AS A CLINICAL INSTRUMENT.[1]

By James E. Talley, M.D.,

PHYSICIAN TO THE PRESBYTERIAN HOSPITAL, PHILADELPHIA

For the skilled cardiologist there is nothing new offered in this paper. For the practitioner who has waited to see if the electrocardiograph would prove a useful clinical instrument there may be desired information. Some five years of experimental and clinical work conducted by various investigators has afforded facts the consideration of which proves the usefulness of the instrument.

About 1856 Kölliker and Müller demonstrated that each contraction of the heart generated electric currents like any contracting muscle. These currents are minute, and it was only about 1900 that Einthoven, a Dutch physiologist, perfected a galvanometer sufficiently sensitive to record them accurately and quickly.

Briefly the electrocardiograph consists of a delicately silvered quartz or glass string 0.002 to 0.003 mm. in thickness, suspended between the poles of the galvanometer by a carrier and attached

[1] Read before the College of Physicians of Philadelphia, November 5, 1913.

by wires to the electrodes leading from the patient. Between the patient and the instrument is a switch-board with several keys whose function is to protect the string, compensate for skin current, bring in or throw out of circuit the body, calibrate the excursion of the string, select the proper lead, etc. The delicate string is magnified by a microscope, and its shadow, vibrating with each heart-beat, is projected by an arc light through the microscope upon the slit of a camera containing a plate or a film moving at a fixed rate and at the will of the operator.

We will briefly review the theory of the electrocardiograph and the electrocardiogram of the normal heart contraction that we may understand the abnormal curves:

Electrodes attached to the patient's extremities will lead off these currents to the galvanometer just as accurately as if the heart were exposed and the electrodes applied directly to that contracting viscus.

That these curves arise from the heart contractions is demonstrated by the fact that the curves obtained by the electrodes attached to the extremities, or attached to the intact chest walls immediately over auricle and ventricle, or attached to the auricle or ventricle laid bare, are all the same. Since the patient has only to lie or sit with his hands and a foot resting comfortably upon the electrodes covered with absorbent cotton, wet with a solution comfortably warm, every sufferer with cardiac disease is not only willing but anxious to lend himself for the study of his malady.

Thus on one hand we have the willing patient for direct examination, instead of drawing parallels between him and the experimental animal, and on the other hand an instrument so sensitive that every heart-beat, no matter how rapid or irregular, is recorded with mathematical precision. Certainly one of the few examples where a branch of medicine is reduced to an exact science.

We cannot as yet explain all the deflections in the electrocardiograms from a presumably normal heart. However, there are variations which are within the limits of health and still further variations which place the individual among the abnormal. It is the measurement of the direction, duration, and time relationships of the events in these curves which forms the basis of electrocardiography. The curves given as normal are the result of the examination and a comparison of a series of curves from a group of healthy individuals. In a large group of presumably normal people there is likely to be found an abnormal curve or so, and a careful examination of the individual will reveal slight abnormalities of the heart never suspected before.

The curves for any given person are constant at all times; so much so, that they have been suggested as an added means of identification of the individual. Any marked deviation from one's particular curve means a deviation in function. Given a normal

curve, we can predicate that the auricular contraction began at the pacemaker (sino-auricular node) and followed the usual course through the auricle; and further, that the normal ventricular complex shows that this impulse reached the ventricles by way of the auriculoventricular bundle, its main branches and their ultimate subdivisions, for it has been demonstrated repeatedly, experimentally, and clinically, that the character of an electrocardiogram, like the curve from a contracting strip of plain muscle, depends upon the point of origin and the direction of the current in the heart.

More often all graphic methods in heart disease are most useful in differentiating the arrhythmias, but the electrocardiograph also yields definite and often unexpected information derivable by no other means in some conditions where the rhythm is *regular*. For instance, there are certain deviations in the directions of parts of the curve, representing each beat, where the rhythm is perfectly regular, that clinical experience has shown to be of bad prognostic significance. Mitral and pulmonary stenosis are cardiac abnormalities which produce clear symptoms and physical signs.

They should be, and postmorten shows that they are, accompanied by the expected right-sided ventricular hypertrophy. Such cases yield characteristic but abnormal curves. That such curves are characteristic of right-sided ventricular hypertrophy is also rendered likely from the following fact: Relative preponderance of the right ventricle is normal in the infant for the first few weeks after birth. Curves of such infants show the same characteristics referred to and keep them until the second or third month, when the child assumes the normal adult form.

The curves of left ventricle hypertrophy show deflections in exactly the opposite directions to those of the right side. We should expect to find these characteristic curves of left ventricular hypertrophy in aortic valve disease, nephritis, arterial sclerosis, and any disease with a constant high blood-pressure. As a rule we do, but they are by no means as constant where expected as are the characteristic curves on the right side.

These abnormal curves on the left side are often absent when expected and appear when not expected. Many electrocardiographic findings and clinical comparisons serve to emphasize the facts that the physical signs which aim to differentiate right- and left-sided ventricular hypertrophy are not always reliable, that increased fluid pressure within the ventricle from an incompetent valve is far from explaining all cases of hypertrophy, and that on postmortem the distribution of increased muscle tissue is not always where expected.

There are evidently factors in hypertrophy which are as yet little understood, but there seems no valid objection to adopting the suggestion of Lewis to speak of right- and left-sided preponderance where these characteristic curves occur. Furthermore, these curves

when sufficient electrocardiographic and postmortem material from the same cases are collected, may help throw more light upon the subject.

We cannot repeat too often that a normal electrocardiogram means that the impulse arose in a supraventricular focus, and followed the normal pathway, the auriculoventricular bundle, throughout all its ramifications to and throughout the ventricles.

Again, the electrocardiograph alone reveals contractions which arise in a supraventricular focus, but follow an abnormal course to the ventricle, the so-called *aberrant* contractions.

For instance, if the left main branch of the auriculoventricular bundle is permanently or transiently deficient the impulse is entirely deflected to the right side of the heart, and though eventually both ventricles contract, the curves of such contractions are abnormal. They partake partly of the nature of the curves of right-sided preponderance or of stimulation near the base of the right ventricle.

If the right main division of the auriculoventricular bundle is deficient the impulse is carried to the left ventricle and the curve simulates the curves of left-sided preponderance and apical stimulation. Though these curves of aberrant contractions simulate the curves of preponderance, the two are fairly easily distinguishable by exact measurement. The only physical signs in a patient with aberrant contractions may be the presence of reduplicated first sounds and some enlargement of the heart on percussion.

The electrocardiograph alone reveals these defects of the main divisions of the bundle. Where this condition is permanent a main stem of the bundle is probably involved in a fibrotic change surrounding it. It is frequently associated with the auriculoventricular heart-block. Right bundle defect is the commonest, and it is most frequently associated with aortic disease.

It may be found that there is an anatomical reason, and the aortic valve and ring thickening may cut off the blood-supply more often to the right ventricle. This condition is of bad prognostic significance. Where temporary it suggests acute involvement of the bundle branch by toxins and bacteria. Lewis has recorded rheumatic cases when the condition cleared up as the fever subsided. Here we have definite evidence of myocardial involvement and an explanation of slight fever explained in some cases by no other means. A galvanometric examination of the functions of the cardiac muscle in rheumatic and other febrile diseases would probably often show that we frequently put patients to bed too late and allow them around too early.

A comparison of our knowledge of the cardiac arrhythmias a decade ago with the wealth of known facts is a glowing tribute to the polygraph, the electrocardiograph, and the workers with these instruments.

Irregularity of the heart's action has been shown to be a complex

subject, and yet capable of being resolved into several more or less simple varieties by these instruments of precision. Moreover, the fixing of these definite clinical entities has added much to our prognostic and threapeutic knowledge of heart disease.

The cardiac irregularities are included under the following heads: auriculoventricular block, extrasystoles or premature beats, simple paroxysmal tachycardia, auricular flutter, auricular fibrillation, sinus disturbances, and alternation.

The electrocardiograph depicts with mathematical accuracy any variation in the conducting function of the auriculoventricular bundle. We know that normally the impulses causing the cardiac contractions arise in the sino-auricular node (at the junction of the superior vena cava and auricle) and travel by the auriculoventricular bundle to the ventricles in at least 0.2 second. Any increase beyond 0.2 second, in this technically named *a–c* or *P–R* interval, is abnormal, and detected with the greatest accuracy by the electrocardiograph. Frequently this increased *P–R* interval, the first step in block, is the only evidence we have that rheumatism or other infective disease has involved the myocardium. With precision the instrument pictures simple prolonged conduction, dropped beats, the varying responses of the ventricle to the auricle, complete dissociation of auricle and ventricle, and finally the exact sites at which the impulses arise which control the independently beating auricle and ventricle. The same curves not infrequently show not only heart-block but right- or left-sided hypertrophy, and premature beats with the exact location of the origin. Furthermore, the slow pulse due to true bradycardia, such as occurs after infectious diseased like influenza, and true nodal rhythm are sharply defined from block.

Premature beats, the commonest cause of intermittent pulse, are shown to be ectopic in their origin, that is, they arise at points other than the sino-auricular node. Their ventricular, auricular, or junctional origin is made clear. If ventricular, the shape of the curve shows whether they arise in right or left ventricle. If auricular, their abnormal curve reveals their ectopic focus of origin, their abnormal course through the auricle; and further, the normal ventricular response shows that the impulse followed the normal path (auriculoventricular bundle) to and throughout the ventricles. Again, if the ventricular response is abnormal to this ectopic stimulation from the auricle, it is shown to be due to deficient conduction in one of the main divisions of the bundle (aberration). Premature beats are easily recognized in electrocardiograms, but in other graphic records, especially where they occur in groups, they may simulate auricular fibrillation, heart-block, flutter, and alternation.

Simple acceleration of the pulse such as occurs in fever, hyperthyroidism, after muscular exercise and emotion, are distinguished by their normal electrocardiographic curves from simple paroxysmal

tachycardia. The latter is due to an ectopic focus in the auricle catching the lead and dominating the rhythm. This focus is usually in the auricle, but occasionally in the ventricle. The electrocardiograms distinguish simple acceleration, simple paroxysmal tachycardia, and auricular flutter.

Auricular flutter, unless treated by digitalis and a higher grade of heart-block than the usual 2 to 1 produced, can rarely be diagnosed accurately except by the electrocardiograph, and that instrument alone reveals the ectopic origin of this abnormal form of heart action. Untreated, this rapid heart action tends to persist over long periods, much to the detriment of the patient with an already overtaxed heart. The good results of treatment are fully worth the trouble of an accurate diagnosis.

Auricular fibrillation demands accurate diagnosis because of its frequency and the usual brilliant results in treatment. True, it can be diagnosed often by the palpating finger, the stethoscope, or the polygraph, but slow fibrillation is easily overlooked if ordinary methods alone are used in diagnosis. The constant absence of auricular contraction variation *P*, and the presence of the oscillations due to the fibrillating auricle in the curves, the perfectly regular pulse with the auricle still fibrillating where complete block is present, the pictures of block, of aberrant ventricular responses, of ventricular extrasystoles with their different foci of origin, as in digitalis coupling, make the curves quite worth while, though the bare diagnosis of auricular fibrillation may be already made by other means. Respiratory arrhythmias and sino-auricular block are worthy of distinct separation from other irregularities not because of their clinical importance, but to allay the anxiety of the patient, and not unfrequently of the physician himself.

In alternation we have perhaps the one condition where the polygraph may give evidence not afforded by the electrocardiograph. However, on the other hand, the latter instrument sometimes shows alternation where the former fails. Recent evidence as to the grave prognostic significance of alternations makes it worthy of study.

The introduction of the phonocardiograph, by which murmurs may be registered graphically simultaneously with the electrocardiogram, should prove useful, especially in teaching the subject of heart disease. This will be more practical, since a form of electrocardiograph is appearing in which two strings may be used in the same galvanometer, one registering the heart contraction (electrocardiogram) the other the heart sounds and valvular murmurs (phonocardiogram)

In the electrocardiograph we have then an instrument which shows whether each impulse that gives rise to a cardiac contraction arises in the normal pacemaker (sino-auricular node) or elsewhere in the auricle or in the ventricle, whether the impulse pursues the normal course through the *A–V* bundle to and throughout the

ventricles, or an aberrant course, and whether the rate of propagation from the auricle to the ventricle was normal or delayed. An instrument which pictures all these facts with mathematical precision must be and is more accurate than the registration of cardiac movements by means of the polygraph, which depicts alone the changes in intra-auricular, intraventricular, and intravascular pressure. However, though the electrocardiograph will be the court of last resort, the ink polygraph, because of its portability, its comparatively small cost, and the large amount of information it is capable of providing, is in no danger of being relegated to the shelf. Again, the knowledge obtained from electrocardiograms makes easier the interpretation of polygraph curves with greater accuracy, and a knowledge of the information afforded by both instruments increases the diagnostic ability of the physician by means of the palpating finger and the stethoscope alone. The different forms of cardiac irregularity have been shown to vary widely in their prognostic significance and their reaction to treatment. In the future the patient will expect, the insurance companies will often require, and the conscientious physician will not rest satisfied without a determination of the exact character of the cardiac irregularity in question.

The increased working reliability of a good electrocardiograph, the decreased price, and the known refinements in diagnosis it affords render the possession of one necessary by every hospital trying to do the best grade of work in cardiac diseases. Since the best deflections of the string are obtained in a strong magnetic field, the electrocardiograph with a *permanent* magnet must prove its worth before its greatly reduced price should be a factor in selecting an instrument.

The writer has attempted to treat the subject in a general way. Those not already familiar with it will find the whole subject technically yet simply set forth in *Clinical Electrocardiography*, by Dr. Thomas Lewis, to whom the writer wishes to express appreciation of his work and of the opportunities to participate therein in his laboratory which Dr. Lewis has afforded those interested in the subject.

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## A SIMPLE METHOD FOR THE INDIRECT TRANSFUSION OF BLOOD.

By W. L. Moss, M.D.,

ASSOCIATE IN MEDICINE, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

(From the Medical Clinic of the Johns Hopkins Hospital and University.)

The method consists of two parts: (1) obtaining blood from the donor, by means of an aspirating apparatus, and its defibrina-

tion by shaking in flasks with glass beads; (2) the introduction, intravenously, of the defibrinated blood into the patient.

*Apparatus Required.* Five Erlenmeyer flasks, each of 300 c.c. capacity, two ounces of glass beads, one infusion bottle, two infusion needles, twelve and one-half feet of rubber tubing, eighteen inches of glass tubing, one thumb-screw, one rubber stopper, with two holes, and four plain rubber stoppers.

*Preparation of the Apparatus.* For the aspirating outfit two pieces of glass tubing, each four inches long, are bent at the middle to form right angles; one end of each of these tubes is passed through the rubber stopper containing two holes, and to the free end of one of these tubes an infusion needle is attached by means of a short rubber connection not over one and one-half inches long. The needle should be about two and one-half inches long, and of fairly large caliber. To the free end of the other glass tube is attached six inches of thick-walled rubber tubing fitted with two inches of glass tubing to serve as a mouth-piece.

Into each of four of the Erlenmeyer flasks is placed one-half ounce of glass beads, and the flasks are stoppered with cotton wool.

The apparatus for the introduction of the defibrinated blood is made ready by attaching a small infusion needle to the infusion bottle by twelve feet of rubber tubing. This tubing is interrupted by two glass cannulæ, three or four inches long, one placed at its middle and the other about three inches from the needle. A thumb-screw is placed on the rubber tubing between the second glass cannula and the needle. All the connections between rubber tubes, glass tubes, and needles are made secure against leakage with heavy silk thread.

*Sterilization of Apparatus.*—The four flasks containing glass beads are sterilized by dry heat, and may be prepared in advance and kept on hand ready for an emergency.

The remainder of the apparatus, consisting of the infusion bottle with its attached tubing, needle, and thumb-screw; one Erlenmeyer flask, four plain rubber stoppers and the rubber stopper with its attached tubes and needle, is sterilized, just previous to using, by boiling.

After sterilization the rubber stopper carrying the needle is fitted into the empty Erlenmeyer flask and a little melted paraffin, which has been heated to 200° C., is aspirated through the needle into the flask, in order to coat the inside of the needle and tube to prevent the blood from coagulating there while it is being taken from the donor.

After the paraffin has been introduced, air must be continuously aspirated through the needle until the paraffin solidifies on the inner walls of the needle and tubing in order to prevent the lumen from becoming occluded. This stopper is now fitted into one of the

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flasks containing beads and a little sterile cotton is inserted into the mouth-piece attached to the rubber tubing.

*Obtaining Blood from the Donor.* The skin over the large veins at the bend of the elbow is rendered aseptic, a muslin bandage is placed around the upper arm tightly enough to cause the veins to stand out prominently, but not so as to obliterate the arterial pulse, the needle of the aspirating apparatus is introduced into one of the large veins, and blood aspirated rapidly into the flask by means of suction applied to the appropriate tube with the mouth.

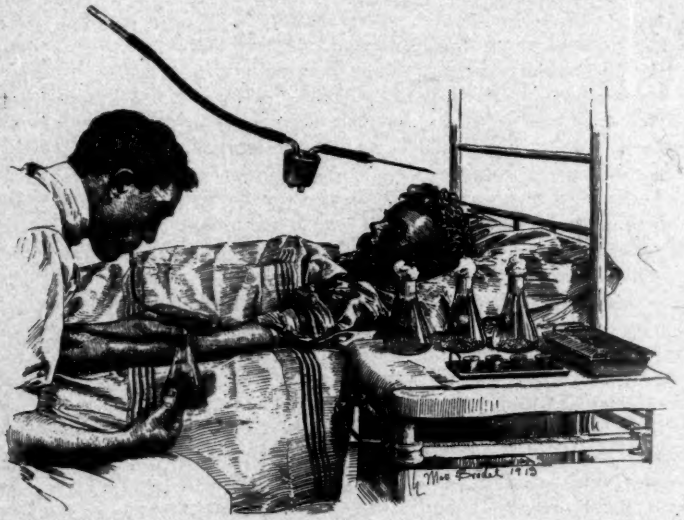

FIG. 1.—Obtaining blood from the donor.

When 200 c.c. of blood have been obtained the flask is gently removed from the stopper without disturbing the needle in the vein, another flask is substituted, and the aspiration continued as before; meanwhile the first flask is closed with a sterile rubber stopper and an assistant immediately defibrinates the blood by shaking it vigorously for ten minutes, using a circular motion. An up-and-down motion is apt to break the flask by throwing the beads violently against its bottom.

A second and a third flask of blood are obtained and treated in the same way; 600 c.c. should yield 500 c.c. of defibrinated blood.

*Injection of the Defibrinated Blood into the Patient.* From 300 to 400 c.c. of sterile normal salt solution are placed in the infusion bottle and allowed to fill the rubber tubing and needle connected therewith. Care must be taken to get all the air out of the rubber tubing and connections. This is somewhat difficult, and is best

accomplished by alternately raising the bottle and lowering the needle several times and then allowing the salt solution to run through the needle until only a few cubic centimeters remain in the bottle. The thumb-screw is now closed; four layers of sterile gauze are placed over the mouth of the bottle and pushed down into it a short distance to form a funnel-shaped depression; the tops of the flasks containing the defibrinated blood are then thoroughly flamed with an alcohol lamp and the blood filtered through the gauze into the infusion bottle.

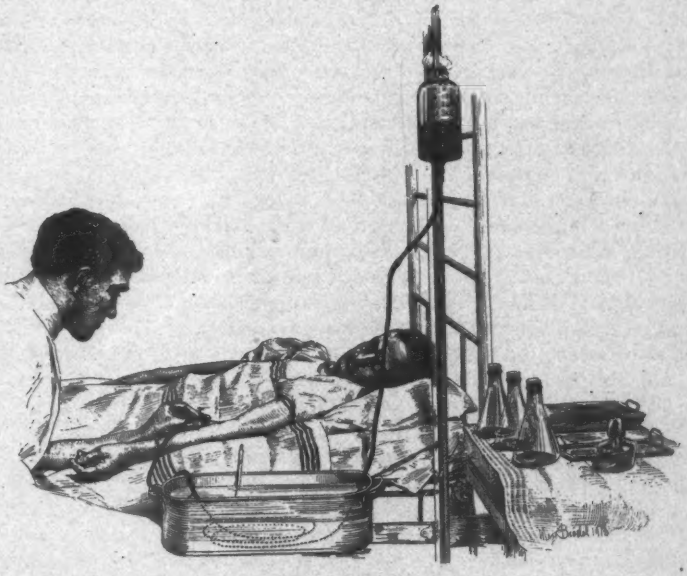

FIG. 2.—Injection of defibrinated blood into the patient.

The skin over the veins at the bend of the patient's elbow is rendered aseptic, a bandage is placed around the upper arm to make the veins prominent, the needle of the infusion apparatus inserted into a vein, and the thumb-screw loosened. If the infusion bottle has not been previously elevated, the back flow of blood from the patient into the glass cannula near the arm indicates that the needle is in the vein. The bandage is now removed and the infusion bottle elevated; the salt solution in the tubing, followed by the defibrinated blood, is allowed to run into the patient's arm.

The infusion bottle is elevated about three feet above the patient's arm and the remainder of the rubber tubing is coiled in a vessel of water placed as near the arm as possible. The water in this vessel should be kept at 38° C., in order that the blood may enter the patient at body temperature.

The rate of flow of the defibrinated blood is regulated by the thumb-screw, so that the patient receives 100 c.c. in six minutes, the introduction of the entire 500 c.c. requiring one-half hour.

In patients with unusually small veins, especially in young children, it may be necessary to expose a vein and use a small cannula if the needle cannot readily be introduced into a vein through the skin.

*Selection of a Donor.* It is preferable that the donor be a vigorous healthy person of approximately normal blood count and hemoglobin percentage. It is important to rule out syphilis by a negative history and Wassermann reaction. No one having an elevation of temperature or recently convalescent from an infectious disease should be used. It is also unwise to use a nephritic patient. I have in a number of instances used as donors subjects of chronic heart disease in whom there was, so far as could be determined, no danger of infection and where a venesection was indicated on the donor's account.

It seems desirable, where possible, to select a donor who belongs to the same group as the patient, as determined by the isoagglutination reaction, in order to prevent the possibility of isoagglutination or isohemolysis. This test is easily performed and does not require more than an hour or two for its application. The method for making this determination has been reported elsewhere.[1]

*The Amount of Defibrinated Blood Used.* The optimum amount of defibrinated blood for an adult seems to be about 500 c.c.; for children, 200 to 300 c.c.

I have given infants of two years 200 c.c., and adults 800 c.c. without untoward results, but better results may be obtained by giving smaller amounts and repeating the injection, if necessary, in from three to ten days.

*General Remarks.* The purpose of this communication is mainly to give the technique of the operation, but a few further statements seem desirable.

I have used it during the past three years in about seventy-five cases. It is easy to perform, although the details require careful attention, and some little practice is necessary in order to acquire facility in its use.

There are several obvious advantages over the direct method. It is much simpler of execution and certain of operation. The amount of blood transfused is under absolute control and can be measured exactly. Except in occasional cases, where it is necessary to expose a vessel, as in very small children, no scar is left with either the donor or donee, and the vessels are not obliterated.

On the other hand, one is using defibrinated instead of whole blood, which differs from the latter in that it contains a large quan-

[1] Studies on Isoagglutinins and Isohemolysins, Bull. Johns Hopkins Hospital, 1910, xxi, No. 228; also Paroxysmal Hemoglobinuria, ibid, 1911, xxii, No. 245.

tity of free fibrin ferment and has been deprived of its fibrinogen. Theoretically, lack of fibrinogen may detract from the value of the procedure in those cases in which the patient's blood may be deficient in this constituent. The presence of free fibrin ferment does not seem to constitute a source of danger, as the body is apparently able to withstand the injection of large amounts of fibrin ferment without harm, and in no instance have I observed intravascular clotting following the introduction of defibrinated blood.

In the series of cases transfused by the method here described there has been only one fatality which could be ascribed to the transfusion. The patient was suffering from pernicious anemia of a severe grade, with renal and cardiac insufficiency. After about six weeks of hospital treatment by the usual methods, without improvement, an indirect transfusion was tried as a last resort, and 500 c.c. of defibrinated blood were given intravenously. There was no immediate reaction, but six hours later the patient lapsed into a comatose state and died three hours after the onset of the coma. It may not be altogether fair to ascribe this fatality to the transfusion, as a week or ten days previous to the transfusion the patient had been in coma for about forty-eight hours, from which, however, he rallied.

In a majority of the cases the introduction of defibrinated blood was followed in from fifteen minutes to one hour by a chill of about a half hour's duration. This was accompanied by an elevation of temperature usually reaching 102° to 104° F., or even higher. The temperature returned to normal in a few hours, and there were no other untoward results.

The gain in the blood-count following the transfusion of 500 c.c. of blood varied between 1,000,000 and 2,000,000 cells, and subsequent observations indicated that the cells introduced live and functionate normally in the body of the recipient.

No instance of blood destruction was observed where homologous blood was used, that is, where the donor and donee belonged to the same group as determined by the isoagglutination reaction. In one instance where the donor and donee belonged to different groups, and where the serum of the donor was shown to hemolyze the patient's corpuscles *in vitro*, a transient but well-marked hemoglobinuria followed the transfusion.

It is beyond the scope of this paper to include detailed case reports; it is intended to give those at another time. The results have led me to believe that as much may be accomplished for the patient by indirect transfusion of defibrinated blood as by the more difficult direct transfusion of whole blood, except possibly in patients whose blood is deficient in fibrinogen.

The technique is published at this time in order that the method may have a more extensive trial in other clinics and in private practice.

# THE ROLE OF THE CAROTID ARTERIES, IN THE CAUSATION OF VASCULAR LESIONS OF THE BRAIN, WITH REMARKS ON CERTAIN SPECIAL FEATURES OF THE SYMPTOMATOLOGY.[1]

By J. Ramsay Hunt, M.D.,

ASSOCIATE PROFESSOR OF NERVOUS DISEASES, COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY, NEW YORK.

Introduction. In recent years, special attention has been given to the more exact localization of vascular lesions of the brain, and as a result a number of new syndromes have been added to the literature of this subject. The object of the present study is to emphasize the importance of obstructive lesions of the main arteries of the neck (the innominate, common carotid, and internal carotids), in the causation of softening of the brain, and more especially to urge the routine examination of these vessels in all cases presenting cerebral symptoms of vascular origin. In other words, the writer would advocate the same attitude of mind toward this group of cases as toward the intermittent claudication, gangrene, and other vascular symptoms of the extremities, and never omit a detailed examination of the main arterial stem.

Hemiplegia from occlusion of the intracranial branches of the internal carotid is one of the most frequent clinical pictures met with in medical practice, and yet apparently one of the rarest from obstruction of the main arterial pathway in the neck. However, when one considers that these vessels are frequently ignored both in clinical and pathological studies, it is not unlikely that many such conditions are overlooked.

The reason for our neglect in this respect is obvious, and springs from the assumption that the circle of Willis is sufficient to carry the blood into an obstructed vascular area when such obstruction is situated below the level of the communicating arteries. There is no question as to the correctness of this assumption in a large majority of cases, especially in young subjects with good hearts and elastic vessels. On the other hand, in those individuals with diseased and weakened hearts and sclerotic vessels, the necessary compensatory changes required for the establishment of the collateral circulation may not develop, in which event any obstruction to the direct flow of blood through the carotid artery must be a considerable menace to the circulation of blood in the affected hemisphere. In such a case, even if the collateral circulation becomes established, it may prove insufficient for the needs of the hemisphere, because of the reduction in force and the consequent slowing of the blood current, when breaking down

[1] Presented at a meeting of the American Neurological Association, June, 1913.

would follow in that portion of the brain commonly involved in failing cerebral circulation; the subcortical white matter, and the region of the basal ganglia. It is also obvious that even if actual softening does not occur, symptoms of diminished functional activity may follow with the characteristic picture of cerebral intermittent claudication.

We also know, that entirely apart from a weakened heart and arteriosclerotic vessels, obstruction of a carotid may produce permanent hemiplegia because of inadequate arteries of communication in the circle of Willis or other vascular anomalies.

It may be well to say, in this connection, that the focus of softening found at autopsy may be merely the breaking down at the distal portion of the arterial tree, where the circulation is weakest, exactly as in senile gangrene of the extremity; the important obstruction to the blood current being situated in the main trunk. Occasionally an area of softening in the region of the central ganglia is found with the vessels of the circle of Willis soft and patulous (Hunt[2]). In such cases the main artery of the neck may well come under suspicion, and should be carefully examined. The same is true of embolism, in which a central area of softening is found without demonstrable occlusion of the middle cerebral. In such cases it is usually assumed that the embolus has been broken up and undergone absorption. This explanation, however, is not always satisfactory, when the vessel is patulous and evidences of secondary thrombus formation are absent.

It would, therefore, seem proper in all cases with cerebral symptoms of vascular origin, to examine the pulsation of the carotids in the neck as possibly throwing some light on the source of the obstruction and rendering more exact our localization of the seat of the trouble in this group of cases. For this purpose a section of the carotid artery is readily accessible to palpation, extending from the lower border of the thyroid cartilage to the angle of the jaw; the main trunk divides into the external and internal carotid at the level of the hyoid bone, and the internal, the larger of the two vessels, is readily felt from this point to the angle of the jaw.

The writer has examined a number of cases during the past few months, at different ages, and suffering from a variety of diseases, and in all of them has found the force of the pulsation in these vessels to be practically equal on the two sides. The only exceptions noted were in a small series of hemiplegic cases of vascular origin, in which a definite and distinct *weakness of the carotid pulsation was noted on the side corresponding to the cerebral lesion.* These cases will be referred to later. It may be well to mention that rarely congenital inequalities in size may occur, and one carotid may even be absent as an extremely rare anomaly.

[2] The Chronic Progressive Softening of the Brain, AMER. JOUR. MED. SCI., June, 1906.

The symptomatology of occlusion of the common carotid artery is based largely on the study of those cases in which ligation was performed, an operation formerly much in vogue for a variety of indications. There are, comparatively speaking, only a few recorded cases of carotid obstruction from endarteritis, thrombosis, and embolism, and of these not a few were associated with aneurysmal dilatation of the arch of the aorta or its branches. We will review briefly these various groups of cases in order to show the different types of cerebral manifestations which may result when the main artery is occluded, and which, after all, is only a *resumé* of clinical pictures with which we are perfectly familiar, and associate with the usual softening processes of the brain, but which are rarely considered as having a possible relation to the carotid artery in the neck.

After-effects of Ligation of the Common Carotid Artery. Ligation of the common carotid artery may produce merely temporary cerebral symptoms, such as unilateral headaches, vertigo, dilatation of the pupil, transient motor and sensory disturbances, which pass away as the collateral circulation becomes established. These are the so-called *immediate* symptoms, and in this group of cases, fortunately a large one, no permanent damage to the brain tissue results.

It would be interesting to know the subsequent cerebral histories of such patients, especially in the later period of life, when the degenerative changes in the circulatory system take place, and if the one hemisphere is more predisposed by reason of defective circulatory conditions to degenerative changes; but I am aware of no investigations bearing on this question.

The so-called *late* or permanent cerebral symptoms which come on after ligation, are the result of organic changes and vary in frequency in the statistics of different observers.

Pilz,[3] who collected and analyzed 520 cases in 1868, found that hemiplegia resulted in 50 cases.

LaFort's[4] statistics, published in 1875, were based on 370 cases, of which cerebral accidents of various kinds were noted in 100.

In Nieten's[5] series of 143 cases published in 1893, cerebral lesions occurred in 27 cases.

In Lestelle's[6] more recent study of 126 cases, cerebral lesions were noted in 11 per cent.

It must be remembered that all of the cerebral accidents cannot be attributed to the vascular occlusion, as other factors such as sepsis and meningitis are to be considered, but some idea of the uncertainty attending the establishment of the collateral circula-

[3] Zur Ligatur der Arteria Carotis Communis, Arch. f. klin. Chir., 1868, Band ix, S. 257.
[4] L'Artere Carotid, Dict. Encyclop. des Sciences Méd. de Dechambre, 1875, T. xii.
[5] Inaugural Dissertation, Rome, 1893. (Cited by Lestelle.)
[6] Des Accidents Cerebraux consecutif a la ligature de l'artere Carotid Primitive, Thése de Paris, 1903.

tion may be obtained and the dangers to the cerebral circulation from obstruction of the main arterial pathway.

The late manifestations consist usually of hemiplegia with or without hemianesthesia, aphasia, convulsions, and the other well-known symptoms resulting from obstruction in the distribution of the middle cerebral artery. Occasionally, blindness or even destruction of the eye may follow on the side of the ligation, from impairment of the circulation in the ophthalmic artery. This is an interesting symptom, and will be referred to later as a diagnostic sign of possible importance.

Before leaving the subject, mention must be made of those cases in which ligation of the carotid has been performed on both sides without ill effects, providing sufficient time has elapsed for the proper establishment of the first collateral circulation, which then conducts the blood to the brain after the second ligation. These cases show what an extraordinary power of adjustment is sometimes possible in the cerebral circulation. It is, however, by no means a certain mechanism, and in a given case one can never foretell what may be the effect of the ligation on the cerebral structures.

Thrombosis of the Carotid Artery from Injury. The carotid artery may become thrombosed after injuries to the neck, such as stab wounds, gunshot wounds, and the like.

The following cases have come under my personal observation, and are reported for their symptomatological interest:

Case I.—A man, aged thirty-two years, was brought to the Hudson Street Hospital on September 31, 1903, immediately after receiving a stab wound on the left side of the neck. There was a small puncture wound in the middle of the left side of the neck, over the sternocleidomastoid muscle, from which there was practically no bleeding. At the site of the wound there was a soft swelling about the size of a pigeon's egg, which was pulseless and yielded no bruit. The patient was conscious and able to tell the history of the accident. Immediately on being stabbed he fell to the ground with vertigo, faintness, and numb feeling on the right side. On admission to the hospital, immediately after the accident, symptoms of right hemiplegia were already apparent.

On October 5. I made an examination at the request of Dr. Stimson. The man was somnolent and apathetic. His pupils were equal and reacted to light. The right side was completely hemiplegic, with considerable loss of sensibility extending to the middle line. The tendon reflexes were present. The abdominal and cremasteric reflexes were abolished on the right side. Babinski phenomenon were present on the right side. There was moderate conjugate deviation of the head toward the left side. The left temporal artery was pulseless. On the right side distinct pulsations were palpable.

Ophthalmoscopic examination shows the left papilla to be pale, the veins moderately full, and the arteries distinctly smaller and less prominent than on the right. The heart sounds were good; pulse, 72; temperature, 101°. The diagnosis of thrombosis of the common carotid artery was made.

October 6. Operation. An incision was made along the left sternocleidomastoid muscle. After a small blood-clot had been removed, the jugular vein was found punctured and was ligated. The common carotid artery was almost completely divided just below the bifurcation and was the seat of a firm thrombosis. The artery was ligated above and below the injury and the severed portion removed.

In the course of the next few days, the patient became gradually more stuporous, and terminal pneumonia developed, with rising temperature, death occurring thirteen days after the injury. The brain could not be examined.

CASE II.—A boy, aged fourteen years, was brought to the New York Hospital, immediately after an injury, on April 30, 1909. He was in an unconscious condition, paralyzed on the right side, and bleeding profusely from a punctured wound on the lower lip and floor of the mouth. He had been injured by falling from a fence upon the iron tip of an umbrella, which entered the left side of the lower lip, passing through the floor of the mouth. According to bystanders he was able to rise, but almost immediately fell to the ground, unconscious, where he remained until picked up by an ambulance surgeon a few minutes later.

Examination, at the request of Dr. Hartley, May 1, 1909, 2 P.M. In addition to the punctured wound of the lip and floor of the mouth there is a swelling beneath the left sternomastoid muscle, just below the angle of the jaw, which does not pulsate. He is unconscious, but can be aroused for brief periods, and is then irritable and somewhat resistant to examination. There is a complete right hemiplegia with diminution of the pain sense on the right side. The right knee-jerk is absent, the left present; both Achilles-jerks and the arm reflexes are present. Babinski present on the right side. Abdominal and cremaster reflexes present on both sides. Pupils are equal and react to light. Heart is normal; systolic blood-pressure is 115 mm. He vomited several times during the day. Temperature, 101°; pulse, 116. Lumbar puncture was performed and three drams of clear fluid remained, which was entirely negative.

May 2. The patient is unconscious, and cannot be aroused. The swelling on the left side of the neck is soft and baggy, and has increased slightly. It does not pulsate. There is neither rigidity of the neck nor conjugate deviation of the head or eye. Pupils are still equal and react to light. There is no pulsation in the left temporal artery. Paralysis and reflexes are as noted in first examination.

*Ophthalmoscopic Examination.* The arteries of the left disk are smaller than those of the right, and do not pulsate. The veins are somewhat fuller on the left side. The left papilla is distinctly paler than the right. Death occurred May 2, at 10.30 P. M.

*Autopsy Note.* The carotid artery of the neck was dissected out and found to be punctured at the bifurcation, and completely thrombosed. The examination of the brain showed some swelling of the convolutions over the parietal and temporal region, and the subjacent white matter was softened and broken down. On opening the corpus collosum, the floor of the left lateral ventricle was found irregularly mottled and soft. The circle of Willis was free except for thrombosis of the middle cerebral artery. Both the anterior and posterior communicating arteries were present and patulous.

*Remarks:* These cases are similar in etiology and symptomatology, and are of interest in the present discussion, as showing the development of immediate cerebral symptoms after puncture wounds of the carotid artery. No doubt this was due to the sudden interference with the cerebral circulation on the wounded side. It is hardly possible that embolism could have occurred so promptly. The steady advance of the softening process terminating in death, was probably due to a slow extension of the thrombus into the cerebral vessels, and which could be demonstrated in Case II. It is to be noted that in both cases there was an absence of pulsation in the temporal artery on the affected side, showing that the external carotid artery was occluded. I would particularly emphasize the slight and distinct vascular changes in the optic disk on the side of the injury present in both of the cases. Such milder disturbances of the circulation in the optic disk as well as optic atrophy, which sometimes develops, may serve to throw light on the localization of the obstruction, showing the lesion to be situated below the ophthalmic branch of the internal carotid.

PRIMARY THROMBOSIS OF THE CAROTID ARTERY (Arteriosclerosis, Endarteritis). Spontaneous thrombosis of the carotid from disease of the vessel wall occurs but rarely, and there are but few cases recorded in the literature of this subject. Among the earlier writers, cases were described by Chevers,[7] Gull,[8] Todd,[9] Savory,[10] and Crisp,[11] usually as a complication of aneurysm of the arch of the aorta or its larger branches. A more recent case of this nature has been recorded by W. Erb, Jr.[12]

[7] Effects upon the Cerebral Circulation of Obliteration of one Common Carotid Artery, London Gaz., i, new series, p. 146.

[8] Case of Occlusion of the Innominate and Left Carotid, Guy's Hosp. Rep., 1855, i, 12.

[9] Med.-Chir. Trans., xxvii, 301.

[10] Ibid., 1856.

[11] Cited by Pils, Arch. f. klin. Chir., Band ix, S. 403.

[12] Ein Fall von Ausgedehnter Gehirn erweichung bei totaler Obliteration der Carotis Communis Sinistra, Münch. med. Woch., 1904, li, 947.

Kussmaul[13] has also described two cases of spontaneous and gradual occlusion of the carotid. One of endarteritis, with complete thrombosis of the vessel, in which the only symptom noted was headache, and a few days before death, visual disturbances. In the second case the left common carotid was occluded and the external carotid was pulseless. The symptoms produced were left-sided headache, vertigo, and epileptiform attacks. The left optic disk was pale, the veins full, and the arteries small. There was no paralysis. He notes that the communicating arteries were but poorly developed.

In Penzoldt's[14] case of thrombosis of the right carotid artery the initial symptom was sudden blindness, the sight of the right eye remaining permanently defective and the disk atrophic. Later a left hemiplegia developed. Autopsy showed complete thrombosis of the right common carotid, with a large area of softening in the right hemisphere. The external carotid was free from thrombosis formation.

Another case of optic atrophy, with contralateral hemiplegia from occlusion of the carotid, is recorded by Guthrie and Mayou.[15] The left carotid was pulseless and the obstruction may have been due to embolism, as the heart action was irregular and a systolic bruit was present.

It is important to remember that symptoms of chronic progressive hemiplegia may follow thrombosis of the carotid artery. Cases of this nature have been described by Oppenheim,[16] Trenel[17] and Brissaud.[18]

In Brissaud's case, a man aged forty-seven, developed gradually the symptoms of hemiplegia, and died in coma. The autopsy revealed a large area of white softening occupying the inferior two-thirds of the Rolandic area, which had a special edematous character. The internal carotid was the seat of an annular endarteritis, which had diminished, but not entirely occluded the caliber of the vessel.

Embolism of the Carotid Artery. Embolic occlusion of the carotid in the neck appears to be even rarer than thrombosis. The only recorded cases are those of Cohn,[19] Eichhorst,[20] and Haffner.[21]

[13] Zwei Fälle von spontaner Allmaliger Verschleisung grosser Hals arterien Stamme, Deutsch. Klinik, 1872, No. 51.

[14] Ueber Thrombose der Carotis, Deutsch. Arch. f. klin. Med., 1881, xxviii, 81.

[15] Right Hemiplegia and Atrophy of the Left Optic Nerve, Proc. Royal Soc. Med., 1907–1908, i, 180.

[16] Lehrbuch der Nerven Krankheiten, 1908, ii, 942.

[17] Cited by Oppenheim.

[18] L'Hemiplegie Progressive, Rev. Neur., 1898.

[19] Klinik der Embolischen Gefäss Krankheiten, 1860, S. 364.

[20] Ueber Emboli der Carotis Communis, Med. Klinik., 1907, iii, 885.

[21] Obliteration der Carotis Communis Sinistra in folge von Embolischer Arteritis bei Herzfehler, Deut. Arch. f. klin. Med., lx, 523.

In Haffner's case there had occurred an embolic occlusion of the left brachial artery in October, 1892. In 1895 there appeared suddenly parietal headache, vertigo, and visual disturbances; no paralysis. A painful swelling developed just below the left ear, and the left carotid and temporal artery were pulseless. Ophthalmoscopic examination was negative. Two years later, in March, 1897, there developed gradually, hemiplegia of the right side, which became complete in about a week. This was accompanied by some sensory loss as well. The patient became apathetic and later demented. Autopsy showed an organized thrombosis of the left carotid, which extended a little beyond the bifurcation. There were small foci of softening in the centrum semiovale on the left side.

Hemiplegia Associated with Diminished Pulsation of the Carotid Artery in the Neck. Under this heading I would call attention to the occurrence of diminished pulsation of the carotid artery in the neck on the side of the softening in cases presenting the symptoms of thrombotic hemiplegia.

Among a series of twenty cases of hemiplegia occurring in advanced life, which I examined for this symptom in the neurological service of the Montefiore Home for Chronic Invalids, it was possible to demonstrate its presence in four cases, all of which presented the clinical picture of an extensive lesion of the hemisphere: hemiplegia with contractures, hemi-sensory disturbances and mental deterioration. The optic nerves were normal on both sides in all four cases.

While inequality of pulsation on the two sides might be accidental, its occurrence in four cases all presenting the symptoms of extensive brain softening is rather significant, and the thought naturally arises that some obstructive lesion of the vessel or its entrance in the arch of the aorta has interfered with the free flow of blood to the brain, which in old subjects with weakened heart would be a predisposing factor in the production of senile softening of the brain.

Of course, further observations and pathological studies will be necessary in order to determine with certainty this point. If, however, these observations are confined, such a diminution in the pulsation of one of the carotids, would be a symptom of some prognostic value before the development of hemiplegia.

Some Concluding Remarks. I would urge that all cases presenting cerebral symptoms of vascular origin, that the main arteries of the neck be carefully examined for a possible diminution or absence of pulsation. Obstructive lesions of these vessels are apparently rare, but it seems certain that cases are overlooked from failure to make clinical and pathological examinations from this point of view.

Probably in the large majority of cases, a sudden obstruction

may occur without softening, producing nothing more than mild, and transient cerebral symptoms. On the other hand, this may so cripple the cerebral circulation in advanced life, that functional deficiencies result and the one hemisphere may be more predisposed to softening processes than the other.

I would emphasize the occurrence of *diminished pulsation of the carotid on the side of the softening as an occasional symptom in cases of thrombotic hemiplegia*, and suggest that the impairment of circulation through the carotid so interferes with the general circulation of the hemisphere as to predispose to thrombus formation and encephalomalacia. A diminished pulsation from this point of view would merit a place as a prognostic factor of importance.

There are various clinical pictures resulting from obstruction of the carotid, similar in symptomatology to those accompanying the intracranial vascular degeneration and diseases. Among these are hemiplegia, chronic progressive hemiplegia, the chronic progressive softening of the brain (Wernicke), and optic atrophy with contralateral hemiplegia.

The distinguishing feature is an absence of the carotid pulse on the side corresponding to the lesion. Should the thrombosis extend to the bifurcation and include the external carotid, the temporal artery on the affected side will be pulseless.

I would also particularly emphasize the occurrence of *unilateral vascular changes, pallor, or atrophy of the disk with contralateral hemiplegia* in obstruction of the carotid artery.[22]

It is also important to note, that the visual disturbances and vascular changes in the optic nerve may precede other organic cerebral symptoms, the collateral circulation failing to develop in the distribution of the ophthalmic artery.

Unilateral headaches and vertigo, especially in assuming the upright posture, epileptiform attacks, failing memory, attacks of threatened hemiplegia, cerebral intermittent claudication, are some of the vascular symptoms which should suggest the possibility of carotid obstruction.

In the realm of pathology, such conditions as chronic edema, indurative, atrophic, and softening processes of the brain, in which the main vessels of the circle of Willis are free from obstruction, should always give rise to the suspicion of impaired circulation in the carotid artery.

These various symptoms and syndromes and their underlying

[22] This syndrome has also been described with intracranial vascular disease: Gowers (Embolism of the Middle Cerebral and of the Central Artery of the Retina, with Autopsy, Lancet, 1875, p. 794); Cadwallader (Unilateral Optic Atrophy and Contralateral Hemiplegia Consequent on Occlusion of the Cerebral Vessels, Jour. Amer. Med. Assoc., 1912, p. 2248); Guthrie and Batten (Unilateral Atrophy of the Optic Nerve Associated with Hemiplegia of the Opposite Side, Trans. Chir. Soc., xxxvi, 52); Elschung (Ueber die Embolie der Arteria Centralis Retina, Arch. f. Augenheil., 1891, xxiv, 65); and Starr (Diseases of the Nervous System, 1910, p. 500).

pathological conditions are all perfectly well-known, but as was remarked in the introduction to this paper, we instinctively associate them with intracranial vascular disease.

It may add to our knowledge of encephalomalacia and the accuracy of vascular localization if the main vessel in the neck is also considered.

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## A STUDY OF THE VALUE OF THE QUANTITATIVE ESTIMATION OF DISSOLVED ALBUMIN IN GASTRIC EXTRACTS (WOLFF–JUNGHANS' TEST) IN THE DIAGNOSIS OF GASTRIC CANCER.

By Frank Smithies, M.D.,

CONSULTING GASTRO-ENTEROLOGIST TO AUGUSTANA HOSPITAL, CHICAGO, ILLINOIS.

(From the Mayo Clinic, Rochester, Minnesota.)

Methods for the estimation of the soluble albuminous products of digestion have frequently been devised with the hope that such might prove of practical service in the differential diagnosis of gastric ailments. Of these methods, the well-known procedure advanced by Solomon had for a time the greatest vogue. Esbach's reagent and tubes proved, however, unsatisfactory and inaccurate from a clinical view-point. More recently the problem has been approached from the practical quantitative side and encouraging work recorded.

Wolff and Junghans[1] report a method for estimation of the amount of soluble albumin in gastric extracts which they claim have given excellent clinical information in Ewald's service at the Augusta Hospital, Berlin.

Theoretically, their procedure has the following basis: In the normal aspirated test-meal there is demonstrable relatively large quantities of soluble albumin by means of precipitating reagents. This soluble albumin appears only through the agency of the gastric enzymes. This fact is proved by testing for soluble albumin a similar test-meal which has been chymified but not swallowed. In such event, only minute quantities of dissolved albumin are present.

Acting on these observed facts, Wolff and Junghans fed similar meals to sets of individuals revealing malignant and benign achylias. Their work appeared to show that in the malignant achylias, aspirated test meals were rich in soluble albumin, while in benign achylias very little of the albumin could be demonstrated.

[1] Berl. klin. Woch., May 29, 1911, and March 18, 1912; Medizinische Klinik, March 24, 1912; Taschenbuch der Magen und Darm Krankheiten, 1912.

Three suppositions have been advanced to explain this increased volume of dissolved albumin in the malignant achylias. It has been suggested that the excess of albumin is due (*a*) to interference with albuminous resorption; (*b*) to a "cancer milk" rich in albumin which exudes from malignant growths, and (*c*) to a specific, peptid-splitting ferment from the neoplasm, capable of carrying protein digestion as far as the completely soluble albumin stage.

Clinically, the reaction was shown to be positive in 18 of a series of 20 gastric cancers and negative in 14 of a series of 15 cases of simple achylia in Ewald's service. Recently, Rolph[2] has reported positive tests in all of 7 cases where cancer was present in the stomach or secondarily involved that viscus. In 8 cases of benign achylia the test proved negative. Rolph states that gastric contents contaminated with blood beyond a dilution of 1 to 3000 may give the reaction and cautions against positive interpretation in instances where there is high combined acid present. In such event peptone is usually present. He claims that cancer of the cardia is not so likely to give positive reaction as is cancer in other parts of the stomach.

AUTHOR'S STUDY. In the last 3950 patients presenting themselves for test-meal examination of gastric function in the Mayo Clinic, there were 747 instances where gastric extracts showed achylia or were associated with conditions likely to be confused with malignancy. These gastric extracts were all tested for soluble albumin by the Wolff-Junghans' method. Records were kept of the association of the results of this test with other test-meal and clinical findings. When the tabulations were completed the diagnoses were entered on the history sheets. In 78.4 per cent. of cases it was possible to obtain check upon diagnoses by operation.

*Selection of Material and Mode of Procedure.* The day previous to the examination of his gastric extract the patient was given 1 ounce of castor oil at 4 P.M. This was followed at 6 P.M. by a motor test-meal consisting of mixed food. At 7 P.M. twenty raw, seedless raisins were given. Twelve hours later (7 A.M. the following morning) the patient was fed 60 grams of second-day bread and 200 c.c. of water. This secretory test-meal was removed from fifty to sixty minutes after administering. The specimen secured was thoroughly mixed, filtered through double hydrochloric-acid-washed papers, and tested for dissolved albumin within an hour of its being obtained from the stomach. On account of the fact that, as has been shown in this clinic,[3] but 52.2 per cent. of cases of gastric cancer yield gastric extracts revealing absence of free hydrochloric acid, and that in 15.7 per cent. of cases, free hydro-

[2] Med. Record, New York, May 10, 1913, p. 849.

[3] Smithies, The Significance of Gastric Ulcer with Respect to Gastric Cancer, Jour. Amer. Med. Assoc., November 15, 1913, p. 1793.

chloric acid ranges between 20 and 50 per cent., we have deemed it advisable to apply the test for soluble albumin not only to achylias, but also to gastric extracts where the free hydrochloric acid was below 20 per cent. In a few instances of suspected malignant ulcer we have performed the test upon gastric extracts with higher free hydrochloric acid content. In such we have been fully alive to the possibilities of error, but for the purpose of gaining information and for comparison we have deemed it wise to make the test.

*Procedure.* Six absolutely clean test-tubes are required for each test. Those of the narrow type and of 20 c.c. capacity answer very well. The tubes are numbered serially from 1 to 6. They receive respectively 1 c.c., 0.5 c.c., 0.25 c.c., 0.1 c.c., 0.05 c.c. and 0.025 c.c. of the filtered gastric extract. These amounts are readily measured by means of a 1 c.c. pipette, graduated in $1-\frac{1}{100}$ c.c. By means of a 10 c.c. pipette, graduated into $1-\frac{1}{10}$ c.c., the volume in each test-tube is next consecutively brought up to 10 c.c. volume with distilled water. This gives from the tubes 1 to 6 dilutions of gastric juice varying respectively from 1 to 10 to 1 to 400 (viz., 1 to 10, 1 to 20, 1 to 40, 1 to 100, 1 to 200, and 1 to 400). These figures we have termed "units" of precipitable albumin. The tubes are then inverted several times to insure complete mixture of their contents. One c.c. of the reagent to precipitate the albumin in solution is then carefully layered upon the contents of each tube. The precipitating reagent suggested by Wolff has proved satisfactory with us. It has the following formula:

| | |
|---|---|
| Phosphotungstic acid (purissimum) | 3 c.c. |
| Hydrochloric acid (concentrated) | 10 c.c. |
| Alcohol (96 per cent.) | 200 c.c. |
| Aq. dest. | q. s. ad 2000 c.c. |

Mix and keep in a glass or rubber-stoppered flask in a cool place.

*Manifestation and Interpretation of the Test.* If there has been dissolved albumin in any of the tubes, the juncture of the Wolff reagent with the diluted gastric extracts is marked by a pearly white zone or "ring." This is better brought out if the tubes are inspected against a black background. (We have used a piece of black cloth such as photographers employ when focussing cameras.) The tubes should be inspected at once after adding the Wolff solution. Prolonged standing allows cloudy zones to form which render comparative interpretation dubious.

We have interpreted our results after Wolff and Junghans' suggestion. If the white ring of precipitated albumin appears in tubes 1, 2, and 3 (namely, units of albumin from 10 up to 50) and no further manifestations are present in the remaining three tubes we have called the test negative. If tubes 1, 2, 3, and 4 exhibit rings (units of albumin from 10 to 100) we have considered the

reaction doubtful. The presence of white rings in tubes 1, 2, 3, 4, 5 and above (units of albumin ranging from 10 to 200 to 400) we have taken to denote a positive test.

*Results.* The gross results of our work are as follows: Of 747 gastric extracts of the class described above, 318 (42.6 per cent.) gave 200 to 400 units of precipitable albumin; 112 (15.7 per cent.) exhibited 100 units, and 317 (42.4 per cent.) showed less than 100 units. In this grouping, 71.5 per cent. of the gastric extracts were from cases showing some degree of gastric retention.

*Consideration of Cancer Cases.* There were 215 cases of operatively and pathologically demonstrated gastric carcinoma in this series. In 141 (65.1 per cent.) units of precipitable albumin ranged from 200 to 400. In 29 instances (13.4 per cent.) there were 100 units of albumin shown. Combining the returns it is evident that 170 (78.5 per cent.) of the proved cases of gastric cancer gave either undoubtedly positive or suspiciously positive Wolff-Junghans' test. In 45 cases (21 per cent.) the test was negative, less than 100 units of precipitable albumin being demonstrated. Of this group of 215 cases of gastric cancer, 73.2 per cent. exhibited some grade of motor stagnation.

Gastric extracts from 15 cases of *ulcus carcinomatosum* were tested. In 11 instances (73.3 per cent.) units of precipitable albumin ranged between 200 to 400. In 3 (20 per cent.), 100 units were shown. In other words, of the 15 cases of malignant gastric ulcer, 14 (93.3 per cent.) were either definitely positive or suspiciously so to the Wolff-Junghans' test. One case (6.6 per cent.) exhibited below 100 units of albumin. In this group, motor stagnation of some degree was present in 86.6 per cent.

Combining the results from the cases of frank gastric carcinoma and those of ulcus carcinomatosum, it is seen that of a total of 230 cases, 184 (80 per cent.) returned positive or suspicious Wolff-Junghans' test.

*Relation of Manifestations of Test to Location of Malignant Process.* We examined gastric extracts from 10 cases of cancer involving the cardia. Six cases (60 per cent.) gave positive test, 1 (10 per cent.) was suspicious, and 3 (30 per cent.) were negative. Thus 70 per cent. of our cases of cancer at the cardia showed units of precipitable albumin ranging from 100 to 400.

There were 5 cases of cancer of the fundus in our series; 1 (20 per cent.) was positive, 1 (20 per cent.) was doubtful, and 3 (60 per cent.) were negative.

We have records of 44 cases where the neoplasm involved mainly the lesser curvature of the stomach. Of this group, 33 cases (75 per cent.) gave clearly positive Wolff-Junghans' test, 4 (9.1 per cent.) were suspicious, and 7 (15.8 per cent.) were negative. It is evident that 84.1 per cent. of cancers involving the lesser curvature show units of precipitable albumin ranging from 100 upward.

In our series there were 3 cases of cancer of the greater curvature. Two cases (66.6 per cent.) were positive and the remaining case suspicious. Thus all showed 100 plus units of albumin.

Eight of our cases were proved to have cancer involving mainly the posterior wall of the stomach. Of this group but 3 cases (37.5 per cent.) were positive to the test, while 5 cases (62.5 per cent.) were negative.

The pars media was involved 14 times. Of this number, 11 cases (78.5 per cent.) gave positive test and 3 cases (21.5 per cent.) were negative.

In 93 instances the malignant growth was at the pylorus and antrum. In this class, 59 cases (63.4 per cent.) showed units of precipitable albumin from 200 upward, 8 cases (8.6 per cent.) were suspicious, revealing 100 units, and 25 cases (26.9 per cent.) were negative. In other words, 72 per cent. of the cancers at the pyloric region gave a positive or suspicious Wolff-Junghans' test.

Our series includes 38 cases where the stomach showed general or extensive malignant involvement. In 26 instances (68.5 per cent.) the test was positive, in 3 cases (7.9 per cent.) it was suspicious, while 9 times (23.6 per cent.) negative results were obtained.

*Comparison of Other Test-meal Findings in the Cancer Cases with the Wolff-Junghans' Test.* It might be profitable here to emphasize the diagnostic relation of other tests associated with that for dissolved albumin in the gastric extracts from our malignant cases. It will be noted above that of the 230 cancer and malignant ulcer cases the Wolff-Junghans' test was positive or suspicious in 184 (80 per cent.). In this same group of cases, free hydrochloric acid was absent in 52.2 per cent., lactic acid was demonstrated in 48.8 per cent., "occult" or altered blood shown in 75 per cent., glycyltryptophan test present in 40 per cent. (141 cases), the average formal index (method of Sorenson and Schiff[4]) was 21 (57 cases), and organisms of the Boas-Oppler group were demonstrated in 93.8 per cent.(146 cases) by the colored agar method.[5] Some degree of gastric retention was shown in nearly 74 per cent. of the entire group of cancer cases, irrespective of the location of the growth.

*The Wolff-Junghans' Test in Extragastric Cancer: Liver and Gall Tract.* Our series includes 15 instances of malignancy in this location. In 5 cases (33.3 per cent.) the test was positive, in 3 cases (20 per cent.) it was suspicious, and in 7 cases (46.6 per cent.) it was negative. Thus 8 cases (53.3 per cent.) of extragastric malignancy showed units of albumin from 100 upward. Some degree of motor stagnation was evidenced in 26.6 per cent. of these cases.

The *pancreas* was the seat of malignant processes three times.

[4] Zeitschrift fur physiologische Chemie, 1909, xiii, 27.
[5] Smithies, Arch. Int. Med., June, 1911, p. 736.

In no instance was a positive Wolff-Junghans' test obtained. Motor defect was not noted in any of these cases.

There was 1 case of cancer of the *transverse colon*. It gave a negative test. There was normal gastric motility in this case.

*Gastric Syphilis.* We have tested gastric extracts for dissolved albumin from 5 cases. The reaction was positive in 2 instances (40 per cent.), suspicious in 1 (20 per cent.), and negative in 2 (40 per cent.). In one of the positive cases the specific process in the stomach was associated with multiple and exuberant ulceration. Gastric motility was interfered with in 1 case (20 per cent.) of this group.

*Primary Anemias* (mainly pernicious). Twenty-four cases of achylia in severe anemia comprised this class. In none of them was gastric stagnation present. Twenty-three (95.6 per cent.) of this group were negative to the Wolff-Junghans' test. In but 1 instance (3.3 per cent.) were the units of precipitable albumin above 200.

*Simple Achylia Gastrica.* We examined gastric extracts from 35 such cases. Gastric stagnation was proved in 4 cases (11.9 per cent.). In 22 instances (63 per cent.) of this type of achylia the test was negative, in 9 instances (25.9 per cent.) suspicious, and positive but 4 times (11.9 per cent.).

*Achylorhydria.* In addition to the cases of absent free hydrochloric acid mentioned in the above groups there were 212 cases of non-malignant disease showing achylorhydria. Gastric motility was impaired in 22 cases (10.3 per cent.). In this group 136 cases (64.1 per cent.) were Wolff-Junghans negative, 41 cases (19.3 per cent.) were doubtful, and 35 cases (16.5 per cent.) were positive.

*Simple Gastric Ulcer.* A number of cases of this affection and of duodenal ulcer were studied for purposes of comparison with the malignant cases. Their gastric extracts generally showed low free hydrochloric acid content. We tested extracts from 33 cases of operatively demonstrated gastric ulcer for dissolved albumin. In 16 instances (48.4 per cent.) units of albumin ranged above 200, in 6 instances (18.1 per cent.) the units ran as high as 100, while in 11 cases (30.3 per cent.) units of albumin were below 100. It is thus apparent that 66.5 per cent. of the proved cases of simple gastric ulcer were positive or suspicious to the Wolff-Junghans' test. Gastric motility was delayed in 39.4 per cent. of this group.

*Duodenal Ulcer.* Gastric extracts from 18 cases of duodenal ulcer were tested. In 12 cases (66.6 per cent.) units of albumin ranged above 200, in 2 cases (11 per cent.) at least 100 units were present, while 4 times (22.7 per cent.) less than 100 units were demonstrated. It is thus evident that 78 per cent. of our cases of duodenal ulcer were Wolff-Junghans' positive or suspicious. In this group, gastric stagnation was present in 55.5 per cent. of the cases.

*Nephritis and Cardiovascular Disease.* Our series include 12 cases of cardiorenal affections associated with obscure gastric complaint and anemia. The gastric extracts showed achylia. In 6 instances (50 per cent.) the Wolff-Junghans' test was doubtful, while in an equal number it was negative. The doubtful cases were associated with some degree of gastric motor insufficiency.

*Cases Exhibiting Low Gastric Acidity.* In this group we include 159 instances where gastric acidity ranged from 2 to 70. The average was 18.7. This group furnished what might be regarded as controls on our reactions in other groups, as well as demonstrated what results might be expected from the Wolff-Junghans' test in extragastric, malignant, and non-malignant ailments. It should be emphasized that all of the patients examined complained of some gastric disturbance. The finding of the low free hydrochloric acid in some instances might have led to suspicions of malignancy by those who hold gastric acidity as a strong index of such condition. This might have been especially so when we recall that the average age of our patients is above forty years.

Clinically, this group was varied as to diagnosis. Among the affections were appendicitis, cholecystitis, cholelithiasis, alcoholic gastritis, gastric neuroses, pulmonary tuberculosis, tabes, multiple sclerosis, tuberculous peritonitis, nephrolithiasis, pancreatitis, cirrhosis of the liver, pregnancy, malaria, diabetes, aneurysm of the abdominal aorta, chronic constipation, hemophilia, cancer of the breast, cancer of the lip, etc.

Of this heterogeneous group of low gastric acidity cases, 40 (25.1 per cent.) were Wolff-Junghans' positive, 38 (23.9 per cent.) were doubtful, and 81 (50.9 per cent.) were negative. In other words, of this class nearly 50 per cent. of cases showed units of precipitable albumin from 100 upward. Gastric motility was interfered with in some degree in 25 cases (15.7 per cent.).

*Relation of the Wolff-Junghans' Test to the Presence of Blood in Gastric Extracts.* We have frequently tested gastric contents that were discolored bright red by traumatic blood without getting positive Wolff-Junghans' tests. Of our entire series of 747 cases herewith detailed, "occult" blood was demonstrated by the benzidin test in 43.2 per cent. Reference to the gross summary of our work above will reveal the fact that we obtained positive tests for precipitable albumin in 42.6 per cent. of the gastric extracts of the entire series, while in 15 per cent. the test was doubtful. There may be more than a curious relationship between these groups of figures.

SUMMARY. The work herewith submitted appears to justify the following conclusions:

1. When carefully performed and interpreted the Wolff-Junghans' test for demonstration of dissolved albumin in gastric extracts was positive or suspicious in 80 per cent. of our series of gastric

cancer. In this series it was a more constant finding in gastric extracts than were absent free hydrochloric acid, the presence of lactic acid, and the glycyltryptophan test. It was rather more constant than tests for occult blood and the demonstration of gastric motor inefficiency. It was not so consistent in its manifestation as the demonstration of organisms of the Boas-Oppler group or the increase in the formol index.

2. In extragastric malignancy, gastric syphilis, and nephritis the Wolff-Junghans' test is inconstant.

3. In the differentiation between malignant and non-malignant achylias the Wolff-Junghans' test, when interpreted in connection with other clinical and laboratory data, is of considerable value. Positive reactions are rarely obtained in the achylias of primary anemia, simple achylia gastrica, and simple achlorhydrias when such are unassociated with gastric motor inefficiency.

4. Simple gastric and duodenal ulcers, especially when accompanied by pyloric stenosis or gastric atony, may give confusing responses to the Wolff-Junghans' test.

5. The presence of blood in gastric extracts may be a factor in the production of certain atypical positive tests.

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## JAUNDICE IN TUBERCULOSIS.

By John M. Cruice, A.B., M.D.

PHYSICIAN TO THE HENRY PHIPPS INSTITUTE OF THE UNIVERSITY OF PENNSYLVANIA, AND TO THE OUT-PATIENT DEPARTMENT OF ST. AGNES' HOSPITAL; INSTRUCTOR IN MEDICINE IN THE UNIVERSITY OF PENNSYLVANIA; FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA, AND MEMBER OF THE JOHN MORGAN SOCIETY.

(From the Henry Phipps Institute of the Univerity of Pennsylvania.)

Jaundice is caused by the presence of bile pigment in the blood. It is now acknowledged that the passage of the bile pigment is by way of the lymphatics into the thoracic duct and thus into the general circulation, and is always caused by some obstruction, whether extrahepatic or intrahepatic, to the normal flow of the bile. Rolleston divides jaundice into: "(1) Extrahepatic or 'obstructive' where there is a gross obstruction, usually involving the larger extrahepatic bile ducts, to the flow of bile along the bile ducts. (2) Toxemic, intrahepatic, or hemohepatogenous, where there is obstruction in the small intrahepatic bile ducts. The obstruction is due to cholangitis or inflammation of the minute ducts, depending upon the irritating effect of poisons derived from the blood circulating through the liver." In tuberculosis we find jaundice caused by both extrahepatic and intrahepatic obstruction to the flow of bile.

The extrahepatic cases have been caused by tuberculous glands in the portal fissure pressing upon the bile ducts. This is a rare condition, from the fact that the glands in the portal fissure receive the efferent lymphatic vessels conveying the lymph away from the liver and not those conveying lymph from the intestines and peritoneum. These glands become infected through the liver, which has become previously tuberculous from material brought by means of the portal vein from tuberculous intestines and peritoneum. Florand reported a case that had been jaundiced for two months. A diagnosis of obstruction of the gall duct by a calculus or neoplasm was made. Operation was performed, but the patient died of hemorrhage from the portal vein, due to injury in trying to remove a bunch of tuberculous glands that extended from the duodenum to the portal fissure of the liver. Hodenpyl reported a case of a colored man who had jaundice which the autopsy showed was caused by occlusion of the common duct by a mass of tuberculous lymph glands. Knight reported a case of a child, aged six years, who had increasing jaundice up to the day of death. The autopsy here also showed a mass of tuberculous lymph glands the size of a walnut in the transverse fissure of the liver and around the hepatic duct and portal veins. Köster reported a case of a three-year-old boy who had been jaundiced for two years. A little while before death the jaundice disappeared. At the autopsy there was found in the portal fissure a tuberculous gland that had become caseous and opened into the common bile duct.

The intrahepatic, toxemic, or hemohepatogenous cases of jaundice occur in those cases where there is tuberculosis of the liver itself. Tuberculosis of the the liver may manifest itself in three ways: (1) miliary tubercles, (2) solitary tubercles, and (3) tuberculous cirrhosis. It is only in the first two forms of tuberculosis of the liver that any cases of jaundice have been reported.

Miliary tubercles of the liver are of frequent occurrence. Arnold considered them almost a constant finding in cases of tuberculosis. Rosenberger found miliary tubercles in 83.8 per cent. of livers examined histologically. Simmond found them in 76 per cent. in adults, in 92 per cent. in children, and in 82 per cent. in general. Ullom in examining histologically 100 livers found miliary tubercles in 79. Rolleston puts the occurrence of miliary hepatic tubercles in fatal cases of ordinary pulmonary tuberculosis lower than 50 per cent. Miliary tubercles are found in the liver in cases of general miliary tuberculosis; in these cases the infection is carried by the hepatic artery; or they are found in cases of tuberculosis of the intestines and peritoneum, and in these cases the infection is carried by the portal vein. Ullom in the histological examination of 79 livers containing miliary tubercles found the position of the tubercles to be periportal 40 times, intra-acinal 17 times, and both periportal and intra-acinal 22 times. In 45 cases, examined

especially to see the relationship between intestinal ulceration and miliary tuberculosis of the liver, 38 cases showed intestinal ulceration. In these 38 cases the tubercles were found periportal 26 times, intra-acinal 3 times, and both periportal and intra-acinal 9 times.

Although miliary tuberculosis of the liver is such a common finding in tuberculous cases, jaundice caused by it is rare. Rolleston states it to be so rare that it is a curiosity. In 570 autopsies performed upon patients dying of chronic pulmonary tuberculosis at the Henry Phipps Institute, there has been only 1 case of jaundice caused by miliary tuberculosis of the liver.

CASE 2252.—A white man, single, aged twenty years, was admitted to the wards on March 31, 1904. Both he and his father had been hard drinkers, and his father had died of phthisis three years before. He had been sick for six weeks before admission, having been treated at another hospital for typhoid fever. He complained of slight cough, moderate expectoration of a greenish-yellow color, constipation, and night sweats. Examination showed advanced disease of both lungs. The heart had a diffuse pulsation over the whole precordium. The second pulmonic was accentuated. No murmurs were heard, and the dulness was normal. The liver extended two finger breadths below the costal margin. The spleen was palpable one and a half finger breadths below the costal margin. The abdomen was distended. On May 5, the patient was slightly jaundiced, not pronounced, simply an icteroid hue. There was marked tenderness over the liver. By May 14 the icteroid hue was less marked. The patient died on June 24.

The autopsy showed tuberculosis of the lungs, with cavity formation, miliary tubercles, edema, pneumonia, and bronchiectasis; parenchymatous nephritis; enlarged mesenteric glands; small ulcer in the appendix; adhesive pleurisy; fatty liver; heart slightly enlarged, valves normal. The liver was enlarged, weighing, 1860 grams. It was of firm consistence, dark red in color, and had rounded edges. Microscopic examination showed a marked grade of congestion, with distention of the capillaries and characteristic miliary tubercles, with large giant cells, epithelioid and round cells, and caseation.

The other type of tuberculosis of the liver in which jaundice manifests itself is the solitary tubercle, which is classified in three ways: (1) conglomerate tubercle, (2) tuberculous cavities or bile duct tuberculosis, and (3) tuberculous abscess. Conglomerate tubercles are comparatively large caseous masses found in the liver. W. Hale White, discussing this condition, says that before these caseating masses break down they may, unless care is taken, be mistaken for nodules of lymphadenoma. These conglomerate tubercles undergo caseation, soften, and at times, when situated

near the bile ducts, rupture into them leaving small cavities in the liver. Solitary tubercles, in whatever form they appear, are an extrenely rare type of tuberculosis of the liver. The writer has been unable to find in the literature a single case of conglomerate tubercles of the liver that showed jaundice. However, two such cases have occurred at the Phipps Institute.

Case 2662.—A white woman, aged forty years, was admitted to the wards of the Phipps Institute August 8, 1904. Her father died at the age of forty-five years of tuberculosis. Mother died at the age of thirty years in confinement. She had one brother and one sister living and well. Two sisters died young of some unknown cause. She had never been sick, but gave a history of excessive use of alcohol over a long period. In the last two years she had lost sixty pounds, and for the past six months had had a cough, worse at night, accompanied by a profuse yellow expectoration. She complained of pain in the lower anterior part of her right chest; dyspnea on exertion, attacks of hoarseness, lasting several days at a time; poor appetite; epigastric pain; distress after eating; constipation; passing blood in the stools; night sweats; slight edema of the ankles. Examination on admission showed an emaciated body, with a face of fairly good color. The heart was normal as well as the abdomen. The lungs showed infiltration of the upper part of the right upper lobe; consolidation, with some softening of the left upper lobe. On August 25 the liver was found slightly enlarged, edges hard, but smooth and not tender. On September 21 the patient was markedly jaundiced; the liver was slightly enlarged. Pressure in the epigastrium caused a great deal of pain. No mass could be felt. On September 26 blood examination showed erythrocytes, 3,840,000; leukocytes, 10,000. The blood was pale and coagulated slowly. The jaundice had become more marked. The conjunctivæ were of a bright yellow color. The whole body was now deeply jaundiced, and pain in the epigastric region was more marked. The liver was distinctly palpable, and the edges sharp and hard. The enlargement was more apparent in the left lobe. On October 1 the jaundice was intense, the abdomen flabby, and distended. There was some free fluid in the peritoneal cavity. Several purpuric spots appeared on the abdomen. From this time on the patient rapidly grew weaker, the jaundice being extreme, pain marked in the epigastrium, sordes on teeth and tongue, pulse weak and irregular, and she finlly died on October 7. The temperature varied between 98° and 101° to 103° until fifteen days before death, when it dropped below normal and so remained until the end. The pulse was between 100 and 120 to 130, and respiration ranged from 27 to 40.

The autopsy on October 8 showed ulcerated tuberculosis of the left lung, tuberculous pneumonia and edema of the right lung, miliary tuberculosis of the spleen, fatty infiltration of the heart,

fatty kidneys, with tubercles. The peritoneum contained about 1000 c.c. of yellow, slightly turbid fluid. The liver was enlarged and weighed 2016 grams; dense and granular on the surface; edges were rounded; its color was pale; scattered throughout were numerous small yellowish-white areas of firm consistence, some few were coalesced. The bile duct was patulous. The gall-bladder was distended with fluid, glycerin-like in consistency. Microscopic appearance: Many caseous areas, containing no giant cells and surrounded by epithelioid and small round cells; there were also typical miliary tubercles containing giant cells. The caseous nodules corresponded to the yellowish-white nodules seen macroscopically, and they contained tubercle bacilli in their periphery. There was an increase in the amount of fibrous tissue.

CASE 9808.—A white woman, single, aged forty-five years, was admitted to the wards of the Henry Phipps Institute August 19, 1911. Her father died at the age of sixty years of heart disease and her mother at the age of forty-five years, of dropsy. Four sisters died in childhood of unknown causes. She had two brothers living and well. In 1908 she had had an attack of typhoid fever, but otherwise her health had been good. She had lost about thirty pounds in the past four or five years, and for the past year had had a cough, worse at night, which was accompanied with profuse yellowish sputum. For the past year she had been dyspneic. Her appetite for some months had been poor, and occasionally she vomited. There had been constipation for the past eight months. She had had night sweats nearly every night for the past year. Examination showed advanced disease of both lungs and the outline of cardiac dulness enlarged. The liver was enlarged and extended below the costal margin. On January 23, 1912, there was noticed jaundice in the conjunctivæ. The jaundice increased, and in two days was marked over the whole body. The liver was markedly enlarged, reaching to the umbilicus. It was quite tender. The stools were loose and of a natural color. The patient was nervous and not clear mentally, She did not answer questions intelligently. The jaundice lessened a little until January 29, when it became a little more intense and then gradually decreased until February 10, the day before her death, when it became markedly increased. All this time the patient had a slight talkative delirium, with some delusions. The liver remained enlarged and tender, and at no time was bile found in the urine or feces. The temperature varied between 95° and 103°, the pulse between 90 and 120, and the respiration between 18 and 36.

The autopsy showed chronic pulmonary tuberculosis, chronic adhesive pleurisy, chronic tuberculous laryngitis, chronic pericarditis, with effusion, tuberculous enteritis and colitis, congenital cystic kidneys, and congestion of the spleen. The liver was enlarged, weighing 2300 grams. It was yellowish-brown in color, firm in

consistency, and had well-marked, rather sharp edges. On section it was yellowish-brown in color, and there were seen numerous small yellow areas, fairly well-outlined, about 1.5 to 2 cm. in diameter, arranged in groups of four or five. Scattered in many places, closer and more numerous, were smaller areas about 1 mm. in diameter. They were poorly defined, raised above the surface, translucent, and gray. In many places the interlobular septum was thickened. Iodine test for amyloid was positive. The gall duct was patulous. The gall-bladder was normal in size, and contained a dirty reddish-brown, thick fluid.

Rolleston in discussing bile-duct tuberculosis states it is remarkable that jaundice is constantly absent, inasmuch as there is definite obstruction in at any rate some of the bile ducts. Bristowe found 12 cases of small tuberculous cavities of the liver in 167 cases of tuberculous ulceration of the intestines, but he makes no statement whether or not jaundice was present in any of them. Thayer has reported a case of tuberculous cavities of the liver which showed jaundice for a week, but cleared up some time before death. Warthin had a case of bile-duct tuberculosis which had intense jaundice for three months before death.

At times the solitary tubercles become secondarily infected with pyogenic microörganisms, soften down, and form abscesses. Mayo-Robson has reported a case of tuberculous abscess of the liver which was successfully operated on and made a complete recovery. He states that for three months prior to the operation the patient had a slight tendency to jaundice.

That jaundice is a rare condition in tuberculosis is admitted by almost all who have had any experience in tuberculosis. Warthin has had a most unusual experience. He states that 80 per cent. of his cases of acute general miliary tuberculosis of the typhoid form have shown a well-defined icterus, either slight, moderate, or well-marked in grade, and about the same percentage of cases of chronic tuberculosis ending in a general miliary metastasis have also shown the same occurrence of jaundice. The writer's experience at the Phipps Institute dealing with chronic pulmonary tuberculosis for the most part had been quite different. In 570 cases that have come to autopsy in that institution, there has been but 3 cases of icterus; the findings in these cases are reported above. In addition to these 3 cases that died in the institute there were 4 other cases (Nos, 379, 1155, 3495 and 4748) that have shown jaundice; 3 of them showed a slight grade of jaundice and 1 a distinct icterus. These 4 cases left the hospital before death, and, of course, we could not prove that the jaundice was due to a tuberculous condition of the liver. These 7 cases of jaundice are all that have occurred in 1748 cases that have been in the wards of the hospital from the time of its inception until February 1, 1912.

From such a small number of cases it is impossible to draw

any conclusions, but taken in connection with cases reported in the literature they are suggestive: (1) Jaundice occurring in the course of chronic tuberculosis is probably due to some form of tuberculosis of the liver, either extrahepatic or intrahepatic. (2) The grade of the jaundice is helpful in surmising the pathological condition, intense jaundice being probably due either to pressure of tuberculous glands on the extrahepatic ducts or to some form of the solitary tubercles of the liver; milder forms being produced by a miliary tuberculosis of the liver.

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## HYALINE DEGENERATION OF THE ISLANDS OF LANGERHANS IN NON-DIABETIC CONDITIONS.

By Russell L. Cecil, M.D.,

Assistant Physician to the Presbyterian Hospital; Instructor in Clinical Medicine in the Columbia University Medical School, New York.

(From the Pathological Laboratory and the Medical Services of the Presbyterian Hospital, Columbia University, New York.)

Hyaline degeneration of the islands of Langerhans was first described in 1900 by Opie,[1] who noted its association with diabetes mellitus. Since then numerous observers have encountered hyaline islands in diabetes, and the condition is now recognized as a common finding in this disease.

In a series of 90 cases of diabetes which I[2] studied in 1909, sclerosis of the islands was noted in 60, and hyaline degeneration

[1] Jour. Exp. Med., 1900 to 1901, v, 397, 527.
[2] Cecil, Jour. Exp. Med., 1909, 266; 1911, xiv, 500.

in 30 per cent. of the cases. Although hyaline change in the islands is so frequently encountered in the diabetic pancreas, its occurrence in the non-diabetic pancreas is rare—so rare, indeed, that the lesion is generally considered characteristic of diabetes. I have been able to find only five references to such exceptional cases in the literature.

The first case of hyaline degeneration of the islands without diabetes was reported by Ohlmacher[3] in 1904. The case was that of an man, aged seventy-two years, the immediate cause of whose death was mastoiditis, with thrombosis of the lateral sinus. At autopsy there was cirrhosis of the liver, chronic interstitial pancreatitis, arteriosclerotic atrophy of the kidneys, and general arteriosclerosis.

Fully four-fifths of the islands of Langerhans showed hyaline degeneration, while many of the surviving ones were hypertrophied. This patient had been under observation for nine months previous to his death, and at no time had he shown any symptoms of diabetes.

Whipple,[4] in 1907, in a study of pancreatitis and focal necroses, refers very briefly to two cases of hyaline degeneration of the islands that he observed in which there had been no evidence of diabetes. The first case was a colored man, aged twenty-three years, who died of tetanus. The anatomical diagnosis was appendectomy, general peritonitis, lobar pneumonia, focal necroses of the liver, cardiac hypertrophy, chronic gastritis, and chronic interstitial pancreatitis. The pancreas showed in addition to chronic inflammatory changes, hyaline degeneration of the islands of Langerhans.

Through the kindness of Dr. Whipple, I have been able to include the second of his cases in the present series. It will be described in detail farther on.

Saltykow,[5] in 1909, noted well-marked hyaline degeneration of some of the islands in the pancreas of a man, aged eighty-eight years, with advanced arteriosclerosis. There were also a number of necrotic foci in the pancreas (fat necroses?). At no time had he shown symptoms of diabetes.

Herxheimer[6] refers to a case of cirrhosis of the liver in which the pancreas was sclerotic and showed in addition a number of hyaline islands. At the time of the patient's death there was no diabetes, but on looking up his past history it was found that diabetes had existed before the onset of cirrhosis of the liver.

Milne and Peters,[7] in 1912, remarked that they had encountered

[3] Amer. Jour. Med. Sci., 1904, cxxviii, 287.
[4] Bull. Johns Hopkins Hospital, 1907, xviii, 391.
[5] Korrespondensbl. f. Schweiz Aerzte, 1909, xxxix, 625.
[6] Verhandl. d. deutsch. path. Gesellsch., 1909, p. 276.
[7] Jour. Med. Research, 1912, xxvi, 405.

hyaline degeneration of the islands in non-diabetic conditions, but beyond that statement proceeded no further in the matter.

Of the 6 cases reported in this paper, 4 came from the clinics of the Presbyterian Hospital, 1 from the pathological department of the New York Hospital, and 1 from the pathological department of the Johns Hopkins Hospital. Synopses of these cases will be found at the end of the paper. A comparative study of these cases might be profitable as a means of approaching the problems of the pathogenesis of diabetes, particularly as regards the part played by the islands of Langerhans. In order to facilitate this comparison, I have prepared a table in which are catalogued the more important clinical and pathological data from the six cases.

TABLE OF CASES.

| Case. | Age. | Sex. | Cause of death. | Pancreas. | Liver. | Kidneys. | Cardiovascular system. |
|---|---|---|---|---|---|---|---|
| I L. M. | 60 | M. | Epithelioma of inferior maxilla. | Chronic interstitial pancreatitis. Many fibrous and hyaline islands. Arterioles thickened. | Moderate cirrhosis. | Fibrous and hyaline glomeruli. Arterioles thickened and hyaline. | General arteriosclerosis. Chronic interstitial myocarditis. |
| II C. H. B. | 43 | M. | Cirrhosis of liver. | Slight chronic interstitial pancreatitis. Fibrous and hyaline islands. Arterioles thickened. | Advanced cirrhosis. | Fibrous and hyaline glomeruli. Arterioles slightly thickened. | General arteriosclerosis. Chronic endocarditis. |
| III M. M. | 50 | F. | Acute pericarditis. | Fat necroses. Moderate interstitial sclerosis and adiposis. Many hyaline islands. Arterioles thickened. | Fatty infiltration. | Chronic interstitial nephritis. Fibrous and hyaline glomeruli. Arterioles thickened. | General arteriosclerosis. Chronic endocarditis. Chronic myocarditis. Cardiac hypertrophy. |
| IV F. W. | 42 | M. | Typhoid fever. | Some sclerosis. Considearble adiposis. Many hyaline islands, a few hypertrophied. Arterioles thickened. | Focal necroses. Cloudy swelling. | Numerous hyaline glomeruli. Cloudy swelling. Arterioles thickened. | Arteriosclerosis. |
| V D. H. | 37 | M. | Endothelioma (?) (left orbit). | Metastases. Slight sclerosis. Many islands hyaline; some hypertrophied. Arterioles slighty thickened. | Metastatic nodules. | A few hyaline glomeruli. Compression atrophy about metastases. Glomerular capillaries thickened. | Slight atheroma of aorta. |
| VI H. T. | 49 | F. | Cardiorenal disease. | Considerable interstitial sclerosis. Many hyaline islands. Arterioles thickened. | Congestion. | Chronic diffuse nephritis. Many fibrous and hyaline glomeruli. Arterioles thickened. | Cardiac hypertrophy and dilatation Diffuse myocarditis and fatty degeneration. Verrucous endocarditis. Arteriosclerosis. |

In the first place it will be noticed that the condition occurred in middle-aged or elderly people, in this respect resembling diabetes. Four of the six cases were in men. None of the cases gave any history of diabetes; in none of them did the urine show glucose while under observation; in none of the cases was there any his-

tory or evidence of lues; in three there was a history of excessive indulgence in alcohol.

The immediate cause of death was an acute infection in 2 cases, a malignant neoplasm in 2, chronic nephritis in 1, and cirrhosis of the liver in 1 case.

The most interesting points from comparison bore on the pathological changes noted in the various organs. In the first place there was noted in every case an interstitial pancreatitis of the type usually seen in diabetes, and more or less thickening of the pancreatic arterioles. The new-formed connective tissue was irregularly distributed, the pancreas appearing normal in some places, while in others there was definite interacinar sclerosis. In Cases IV and V the sclerosis was slight and visible at only a few points. The islands were in no instance entirely destroyed; on the contrary, perfectly normal islands could always be found. A certain number, however, showed more or less extensive hyaline degeneration, which apparently originated about the thickened insular capillaries. The hyaline changes were associated in most instances with a certain amount of insular sclerosis. So far as the pancreas was concerned then it would have been impossible to distinguish the lesions from those observed so frequently in diabetes.

In two of my cases there was a well-marked cirrhosis of the liver, a condition which also occurred in the cases of Ohlmacher and of Herxheimer. In Herxheimer's case there had previously been some glycosuria, but at the time of the hepatic cirrhosis the glycosuria had entirely disappeared. Herxheimer suggested that the disappearance of the glucose might have been dependent in some way on the development of the hepatic cirrhosis.

The condition of the kidneys in my series is particularly interesting. In every case there was a definite fibrosis and hyaline degeneration of some of the glomeruli, associated with sclerosis of the renal arterioles and glomerular capillaries. The lesions were not advanced (except in two of the cases) and were confined for the most part to the glomeruli. The frequent association of chronic nephritis with diabetes has been often observed, especially in those cases where arteriosclerosis is present. Indeed, it is the arteriosclerotic type of nephritis that is usually seen in this connection.

In view then of the frequent association of diabetes and arteriosclerosis it is significant that in the present six cases of pancreatic and insular lesions, arteriosclerosis was noted in all, in four instances being associated with cardiac lesions. In Cases IV and V, the vascular changes were slight and largely confined to the smaller vessels of the pancreas and kidney, while in the remaining cases the process was more generally distributed.

Discussion. What bearing has the occurrence of hyaline degeneration of the islands of Langerhans in non-diabetic conditions on the island theory of diabetes? For my own part I cannot see

that it vitiates that theory in any way. Certainly, no one would think of doubting the effect of sclerosis and hyaline degeneration of the glomeruli on renal efficiency, because one sometimes sees hyaline glomeruli in a kidney which during life has manifested no signs of disease.

Two explanations are open to us. In the first place it is quite possible that the destructive process in the islands has not advanced far enough to produce diabetes. The number of islands varies greatly in different individuals. Those with a large number could probably stand considerable destruction of island tissue without showing symptoms, for Nature has doubtless provided many more islands than are actually needed for efficient carbohydrate metabolism. Organs are constantly being encountered at the post-mortem which, while diseased, had not advanced as yet to the symptom-producing stage; for example, cirrhosis of the liver without jaundice or ascites, shrunken kidneys without albuminuria, endocarditis without incompetence, etc. So it may be assumed that destruction of the islands must progress to a certain point before glycosuria appears.

The other explanation is that the patient had diabetes at one time, but that other organs have vicariously assumed the pancreatic function with so much success that they have completely supplied the deficiency in that organ. Personally, I should rather favor the former hypothesis for the reason that in no one of the six cases had the hyaline degeneration involved all the islands. Moreover, one would expect to see more evidence of regeneration or hypertrophy of the islands if at any time there had been much demand for an increase in their functional activity. In a previous paper I[8] have shown that in a considerable proportion of diabetic pancreases there has occurred more or less regeneration and hypertrophy of the islands, the new-formed islands budding off from the ducts after the manner of those observed in the fetal pancreas. The absence of this phenomenon may be taken to suggest that in the six cases which have been reported diabetes had at no time existed.

An interesting phenomenon observed in this study is the coincidence of hyaline degeneration of the islands and of the glomeruli. In the kidney, fibrous and hyaline glomeruli are very common, and have usually been interpreted as the sequel of renal arteriosclerosis. Possibly the same explanation holds for hyaline changes in the islands of Langerhans. It is conceivable that in both instances the vascular changes have involved particularly the capillaries supplying these structures, with the result that sclerosis and hyaline degeneration have ensued. And just as arteriosclerosis is now recognized as the usual precursor of the so-called "contracted kidney,"

[8] Loc. cit.

with its interstitial fibrosis and glomerular lesions, so pancreatic diabetes may eventually be shown to depend upon a preëxistent arteriosclerosis, which, interfering with the pancreatic vascular supply has induced an interstitial pancreatitis and degenerative changes in the islands of Langerhans. I would also put forward the suggestion that the hyperglycemia which has been observed in cases of arteriosclerosis, with high tension, might be explained by the same theory as an incipient disturbance of the internal secretion of the pancreas due to pancreatic arteriosclerosis.

SUMMARY. Six cases of hyaline degeneration of the islands of Langerhans, in which there was no evidence of diabetes have been reported. All occurred in subjects aged over thirty-seven years. In addition to the hyaline changes there were found in every case more or less sclerosis of the insular capillaries, and a chronic interacinar pancreatitis of the type usually encountered in diabetes mellitus.

The explanation of this phenomenon, which has seemed most likely is that hyaline degeneration of the islands, may occur up to a certain point without producing diabetes. When a number of islands, sufficient to interfere with carbohydrate metabolism, have been involved, diabetes ensues.

The hyaline changes in the islands of Langerhans have been associated in every case with hyaline degeneration of the renal glomeruli. The lesions in both instances are possibly referable to sclerosis of the smaller vessels supplying these structures.

## SYNOPSES OF CASES.

CASE I.—L. M., male, aged sixty years. Admitted to Dr. Blake's service at the Presbyterian Hospital with epithelioma of lower jaw. Urine free from glucose. Patient died following partial resection of lower jaw.

Autopsy 8081. Anatomical diagnosis: Amputation of the left inferior maxilla (epithelioma), acute bronchopneumonia, general arteriosclerosis, chronic interstitial myocarditis, cirrhosis of the liver, cholelithiasis, chronic interstitial pancreatitis, chronic diffuse nephritis.

Pancreas: Small and firm. On section it contained considerable fatty tissue. Microscopically there was an irregularly distributed sclerosis and fatty infiltration. Arteries were thickened and hyaline. The epithelium lining the larger ducts had undergone adenomatous proliferation. Islands were numerous, some appearing normal, others sclerotic, still others, perhaps 25 per cent., showed more or less hyaline degeneration.

Liver: Weight, 1210 gm. Surface smooth, but on section, lobules were small and distinct. Microscopically there was considerable

increase of the interlobular connective tissue and infiltration of lymphoid cells. Hepatic arteries were thickened and hyaline.

Gall-bladder: Contained a large stone.

Kidneys: Weight (together) 290 gm. Macroscopically they showed nothing of interest. Microscopically the glomeruli showed fibrous and hyaline changes. There was considerable granular degeneration and disintegration of the tubular epithelium. Arterioles were thickened and hyaline. The thyroid and suprarenals were normal.

CASE II.—C. H. B., male, aged forty-three years; moderately alcoholic. Admitted to the medical service of the Presbyterian Hospital, with jaundice and continuous fever. After several weeks of observation he was transferred to the surgical side for exploratory laparotomy. At operation, cirrhosis of liver and ascites were found. Patient died several days after the operation. Repeated examinations of the urine were negative.

Autopsy 7781. Anatomical diagnosis: Cirrhosis of the liver, chronic endocarditis, chronic glomerular nephritis, chronic interstitial pancreatitis, general arteriosclerosis, chronic interstitial splenitis, acute bronchopneumonia.

Pancreas: In the gross was apparently normal. Microscopically there were patches of sclerosis here and there. Small arteries were thickened and hyaline. Islands were sclerotic and in many cases hyaline. The stroma was infiltrated with lymphoid cells in places. Ducts were normal.

Liver: Weight, 1440 gm. Surface was markedly granular. On section the organ was tough and the cut surface was granular, the yellow elevated lobules being separated by pale gray tissue. Microscopically there was typical cirrhosis in the advanced stage, with extensive new formation of small ducts and dense infiltration of stroma, with lymphoid cells. Hepatic arteries thickened and hyaline. Portal capillaries were dilated.

Kidney: Some of the glomeruli had been converted into hyaline or fibrous tufts. There was slight thickening of some of the vessels. Tubular epithelium was broken down in places.

CASE III.—M. M., female, aged fifty years. Admitted to the second medical service of the Presbyterian Hospital during an exacerbation of arthritis deformans. Urine showed faint trace of albumin and casts, but no glucose at any time during her stay of one year in the hospital. The patient died of acute pericarditis.

Autopsy 7981. Anatomical diagnosis: Acute serofibrinous pericarditis, chronic endocarditis (mitral and aortic valves), hypertrophy of heart, chronic interstitial myocarditis, chronic interstital nephritis, fatty infiltration of the liver, chronic interstitial pancreatitis, fat necroses in the pancreas, general arteriosclerosis, hypertrophic arthritis deformans, etc.

Pancreas: Firm and of good size. Small yellowish areas scattered

over the surface. Islands visible. Ducts normal. Microscopically there was some increase of the stroma in places and considerable adipose tissue was found between the lobules. Here and there were collections of lymphoid cells, and at some points in the fatty tissue there were seen small foci of necrosis, surrounded by leukocytes. The islands were numerous and rather large. About two-thirds of them showed definite hyaline changes, the process being advanced in some cases. Small arteries were thickened and hyaline.

Liver: Centres of lobules congested. Hepatic arteries showed considerable thickening and hyaline degeneration.

Kidney: Well-marked increase of stroma in the cortex, especially about the glomeruli; the latter showed fibrous and hyaline changes, moderate infiltration of stroma, with lymphoid cells. Small arteries were thickened and hyaline. The cells of the convoluted tubules were in places granular and vacuolated.

Thyroid: Slight increase of stroma. Suprarenals and hypophysis were normal.

CASE IV.—F. W., male, aged forty-two years. Admitted to the second medical service at the Presbyterian Hospital for typhoid fever. Died ten days after admission, with bronchopneumonia. Urine was negative.

Autopsy 8197. Anatomical diagnosis: Typhoid fever, typhoid ulcers of the ileum and ascending colon, acute splenic tumor, focal necroses of the liver, cloudy swelling of the viscera, fragmentation of the heart muscle, bronchopneumonia, acute fibrinous pleuritis, chronic interstitial pancreatitis, slight arteriosclerosis. Atheroma of aorta.

Pancreas: In the gross appeared normal. Microscopically there was considerable fatty tissue between the lobules. Parenchyma were well-preserved. There was some increase of the interstitial tissue in places. The islands were not noticeably increased in number. Some of them were normal, but at least half of them showed more or less extensive hyaline degeneration. In some there had been almost complete destruction of the island cells. A few islands were hypertrophied. Arterioles were thickened.

Liver: Swollen and cloudy. Gall-bladder and ducts were normal. Microscopically there was considerable postmortem change. Vacuoles were numerous. There was well-marked focal necrosis, generally about the central veins.

Kidneys: Measured 11 x 5.5 x 3 cm. Fibrous capsule slightly adherent. Surface and cut surface appeared normal. Microscopically there was some granular degeneration of the tubular epithelium (probably postmortem); hyaline glomeruli were numerous. Arterioles were thickened.

CASE V.—H., male, aged thirty-seven years. Admitted to New York Hospital complaining of pain in abdomen and diarrhea.

Physical examination (on admission) showed the liver enlarged, edge 9½ inches below costal margin, firm but not tender. Patient's head was considerably enlarged, and there was marked bulging of the left eye. Patient was in the hospital about a year. Repeated examinations of the urine showed a trace of albumin and hyaline and granular casts, but no glucose.

Clinical Diagnosis: New growth of liver.

Autopsy 4465. Anatomical diagnosis: Tumor (endothelioma?) of the left orbit; metastases in liver, kidneys, pancreas, lungs, heart, bronchial, and retroperitoneal lymph glands; abscess of the lung, acromegaly, arteriosclerosis.

Tumor of the Orbit: Right orbit contained a tumor the size of a bantam's egg, situated between the base of the orbit and the optic nerve, easily removed, adherent to sheath of optic nerve; consistence firm; cut surface was grayish pink and granular. Eyeball pushed forward; base of orbit was slightly eroded.

Microscopic Examination: The tumor was composed of alveoli filled with small, flattened endothelial cells, with large chromatic nuclei and small amount of pale cytoplasm. In some places the connective tissue was scanty and the alveoli large; in others the stroma was very abundant and richly vascularized and infiltrated with cords of tumor cells.

Liver: Greatly enlarged, and contained many small tumor nodules.

Microscopic Examination: Sections through tumor nodules differed in no way from those of original tumor.

Pancreas: There were numerous small tumor nodules in the pancreas similar to those in the liver. The tail of the pancreas, though free from tumor, appeared rather firm. Ducts were patent. Microscopically there was a slight increase of connective tissue in some places about the ducts, elsewhere the stroma as well as the glandular acini appeared normal. At least three-quarters of the islands of Langerhans showed hyaline degeneration, which in some cases was advanced. Islands were hypertrophied. Arterioles were slightly thickened. Larger ducts showed adenomatous hypertrophy of lining epithelium. Metastases composed of tumor cells, similar to those in liver. In places they completely surrounded the islands, which may have been normal or hyaline.

Kidneys: Weight (together), fifteen ounces. Upon stripping off the capsule small tumors were seen projecting above the surface, which was otherwise smooth. On section the markings were indistinct. Tumor nodules were scattered through the cortex; pyramids appeared normal. Microscopically there was granular degeneration of the tubular epithelium; a few of the glomeruli showed hyaline degeneration. Glomerular capillaries thickened. Tumor nodules were similar to those described above.

Hypophysis: Enlarged, size of small walnut, and soft.

Microscopic Examinations: Section showed a richly vascularized connective tissue supporting a large number of solid glandular tubules containing rounded or flattened epithelial cells. Occasional hollow tubules lined with low cuboidal cells and filled with colloid material were observed.

CASE VI. — H. T., female, aged forty-nine years; colored. Admitted to the Johns Hopkins Hospital for chronic nephritis.

Autopsy 2895. Anatomical diagnosis: Chronic diffuse nephritis (large white kidney), cardiac hypertrophy and dilatation, diffuse myocarditis and fatty degeneration; verrucous tricuspid, and aortic endocarditis, hemorrhagic gastritis, catarrhal enteritis, general anasarca, edema and atelectasis of lungs, myomas of uterus, pelvic peritonitis, general arteriosclerosis, chronic pancreatitis, colloid goitre, obesity.

Pancreas: Normal in size and consistence. Cut showed distortion of lobules. Ducts were dilated and a little thickened.

Microscopic Examination: There was considerable increase of the interstitial tissue, with atrophy of many of the acini. Islands were fairly numerous. Insular capillaries were thickened. A considerable number of the islands had undergone hyaline degeneration, and in some cases to an extreme degree.

Kidney: Microscopically there was extensive replacement of the cortex by fibrous tissue, with considerable granular degeneration and desquamation of the tubular epithelium. There were many hyaline and fibrous glomeruli. Well-marked thickening of the renal arterioles was observed.

Liver: Microscopically there was congestion of the lobules about the central veins, with some compression atrophy of the cells.

NOTE.—I am indebted to Dr. George H. Whipple, of the Johns Hopkins Hospital, and to Dr. William J. Elser, of the New York Hospital, for pathological material and for permission to report two of the cases included in this study.

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## ALCOHOLISM AND EPILEPSY, ALSO SO-CALLED ACUTE ALCOHOLIC EPILEPSY.[1]

BY N. S. YAWGER, M.D.,

EXAMINING PHYSICIAN TO THE PENNSYLVANIA EPILEPTIC HOSPITAL AND COLONY FARM, PHILADELPHIA.

(From the Department of Neurology in the University of Pennsylvania.)

THE craving for alcohol and alkaloids or substances that are similar to these in their action is so universal as to appear almost

[1] Read before the Chester County Medical Society at Embreeville, Pa., July 8, 1913.

instinctive. From cereals, fruits, plants, seeds, and tubers, man has obtained substances for such use, and those commonly employed have been the various alcoholic beverages, cocoa, coffee, guarana, hemp, kola bean, maté, opium, tea, and tobacco. Such substances have been drunk, chewed, smoked, inhaled, used subcutaneously, and otherwise introduced locally. Habits of this kind were in vogue among the ancients even in the earliest times. There are records that tell of the use of wine 5000 B.C. And since it appears that man always has craved something to soften his sorrows and to add to his pleasures, there is no likelihood that we shall become absolutely free from this human weakness.

Having, then, these habits always with us, it is of the utmost importance to be familiar with the harm that results from such indulgence. This is a difficult problem, for upon no subject within the domain of medicine do such extreme views obtain as upon that of the use of intoxicants. Of all habit-engendering substances, alcohol is the one most commonly used, but a number of factors must be borne in mind in determining the effects produced by such use. The quantity and the quality of the liquor; the time of day taken, and the period of time over which it is consumed; and not the least important factor is the physical and mental make-up of the individual. The matter of tolerance is significant. It has been defined by Hare, of England, "as the capacity to ingest relatively large amounts of alcohol without experiencing the ordinary obtrusive physiological effects."

Although we know that at times alcohol may be used in enormous quantities and for a long period without showing appreciable deleterious effects, we also know that it may cause death acutely or it may bring about widespread degeneration through years of excessive indulgence. The pathological changes extend to all tissues except bone, but its effects are especially marked in the nervous system. The particular affinity of alcohol for this part of the body is shown even after death, when it may be found in the cerebrospinal fluid after all trace has disappeared elsewhere. In the nervous system both functional and organic disturbances are observed. Mental manifestations with alcoholism as a factor are especially numerous, and any type of insanity may be simulated. However, the only mental disorders which are distinctly the result of the prolonged action of alcohol upon a previously normal brain are delirium tremens and polyneuritic psychosis (Korsakow's disease), and even the latter is occasionally produced by the absorption of septic matter, and it is also said to have followed influenza and typhoid. All other psychoses occurring among alcoholics are of the types of those developing among abstainers.

Many believe that in the offspring of alcoholists there is a proneness to hysteria, insanity, idiocy, epilepsy, and crime. But here it is important to remember that the nervous instability which may

have led the parents to drink, may also account, at least in part, for these disorders and diseases developing in the offspring.

At times information is gathered that is worse than useless; it is misleading. Mott, a distinguished English writer, says: "The great point in any scientific observation is not to try to prove something, and to avoid any propagandistic tendency, thus the question of alcohol and insanity is an illustration in point. The Council of Fifty in Massachusetts investigated the number of patients admitted to asylums in which there was an alcoholic history; it was then suggested that they might investigate the number of total abstainers; it was found that they were quite as numerous."

Of special interest is the relation of alcoholism to epilepsy; it is concerned with this disease in several ways, and yet it probably is not as potently a factor in the causation of epilepsy as is often stated, for we have not sufficiently taken into consideration the nervous instability which frequently has led the parents to drink, and which in itself must have been partly, and at times perhaps wholly, responsible for the development of epilepsy in the offspring. It also appears that only rarely does chronic alcoholism produce recurrent attacks of fits, except as they are dependent upon the immediate taking of alcohol. This latter subject will be considered somewhat in detail later.

Alcoholism has, or is alleged to have, the following relations to epilepsy:

1. Drunkenness of one or both parents at the time of conception has been said to be a fruitful cause of epilepsy in the offspring (Esquirol). This is an exceedingly difficult matter to investigate, as the nature of the sexual act forbids observation. However, there is data which indirectly throws light upon this subject. In France it is said that a considerable number of children appear nine months after seasons of drinking, such as carnivals in the cities and church fairs in the country. It has also been observed in some countries that the congenital epileptics and imbeciles are conceived at the time of new wine. It is held, as a rule, in the wine countries that a poor school year comes seven years after a good wine year.

2. That injuries to the head in alcoholists may give rise to true epilepsy is stated by Oppenheim. This is quite possible just as alcoholism plus traumatism may cause insanity; and also, a blow upon the head in a syphilitic may act in the same way.

3. Chronic alcoholism in the parents may lead to epilepsy in the offspring; while reliable statistics are here wanting, it is probable that this is often one of the factors in the production of epilepsy.

4. Chronic alcoholism in the individual may lead rarely to epilepsy in those with no inherited or inherent tendency to the disease. This surely does not often follow except in cases of senile

epilepsy, where the attacks are rather an epileptoid manifestation and dependent upon an arteriosclerotic basis. Such attacks are less frequent and less severe, and the mental failure is not so marked, the condition also yields somewhat more satisfactorily to treatment than does the idiopathic disease.

5. In an epileptic who becomes an alcoholist, the attacks are increased in number and in severity. Of the marked intolerance of epileptics to alcohol, there can be no question. All epileptologists have met with instances where the disease has undergone a remission and where attacks have been again precipitated by the taking of alcoholic beverages.

6. Alcoholic drinks may be sought by epileptics because of post-epileptic depression, and there may be little or no drinking at other times. The disease, of course, is exaggerated.

7. A few epileptics upon becoming aware of the dreadful malady with which they are afflicted, have plunged into drink and greatly aggravated their disease; and this, independent of the depression which is sometimes the direct result of the attacks. Here, epilepsy is the exciting cause of alcoholism.

By those in charge of alcoholic wards in hospitals, the phenomenon of convulsions is frequently observed. This may be due to uremia, and it also occurs in epileptics who have gotten drunk. But there is another variety of convulsive disorder seen, and this has received but little attention at the hands of writers upon alcoholism; some even fail to mention it. We refer to so-called acute alcoholic epilepsy. The term "epilepsy" is here unfortunately used, since these attacks have no more relation to epilepsy than have the convulsions so commonly seen in children. As a rule, there is but little albumin in the urine of these patients, and this usually clears up in a few days. Contrary to the belief of a number of physicians, alcoholic convulsions and delirium tremens appear in most instances to be abstinence phenomena. They do not usually occur together, although occasionally this is observed. It is argued that these two diseases sometimes develop while the patient is still drinking heavily; in some of such cases perhaps there has suddenly developed a catarrhal condition which has prevented the absorption of alcohol; or it may also arise through a patient being profoundly intoxicated and therefore not conscious enough to continue drinking. These fits are most apt to occur in continuous alcoholists in whom a rather high degree of tolerance has been attained, and they are most likely to obtrude themselves during the first twenty-four hours of abstinence. When attacks of delirium tremens are present they occur a little later. These convulsions are not preceded by insomnia, tremor, and fear unless they are accompanied by delirium tremens. The attacks bear considerable resemblance to genuine epileptic seizures. They are mostly major; an injury may be sustained by falling, unconsciousness is complete, the tongue at times is bitten, sleep often follows

the attack, and the patient usually awakens with a headache. But still there is not the characteristic appearance of an epileptic, and the patient usually bears the stamp of a chronic alcoholic; the attacks seldom occur independently of drinking.

The prominence given alcohol as a cause of epilepsy has been overestimated, and this is apparent from the following: The nervous instability which at times drives parents to drink is in part responsible for the development of epilepsy in the offspring. We know that drinking is very common and epilepsy is relatively rare. Alcoholism is much more frequently encountered in males, but epilepsy at least is as common among females. Many of the cases of epilepsy have developed before the age when drink could be obtained. Insanity and nervous diseases are common among the Jews; epilepsy is frequently seen, and yet the Jews are an abstemious people. Those of us who have done special work among alcoholics know that a drunken Jew is a great rarity. The report of the Craig Colony for Epileptics for 1912 gives alcoholism as the probable cause of epilepsy in less than 1 per cent. of the admissions for that year, 227 patients were admitted. And, finally, even those alcoholists with no inherited or inherent tendency to epilepsy, who have convulsions (so-called alcoholic epilepsy), almost never have fits independent of drinking.

A great deal is heard about the rapid increase in the number of epileptics, but the writer believes here we stumble against some of the errors which have arisen in estimating the number of insane. It is only in recent years that we have had special institutions for the care of epileptics so that we are only just beginning to obtain data from which to draw more definite conclusions as to etiology. The conditions conducive to epilepsy and insanity may not parallel each other, but they probably do run in much the same direction.

The writer knows of no reason for believing that through racial degeneration, insanity is increasing rapidly, and this, perhaps, is worthy of a moment's consideration. Years ago it was thought to be more of a disgrace to go to an asylum or sanitarium than it is today; the insane are now infinitely more humanely cared for than formerly, and there is less fear among the relatives about having one of their family leave home; therefore, many are now available for statistics which were formerly missed. The horrors that existed in the so-called mad-house are familiar to us all, patients were chained to the walls, they were otherwise abused, and death frequently resulted from accidents, houses of detention were unsanitary, and many died because of such unhygienic conditions.

I think it probable that there is a slight relative increase in the number of insane, and this, in a measure, may be accounted for through our present scientific care of weaklings; thus, children are kept alive today who years ago could not have lived, and consequently we have the survival of the unfit, some of whom are imbecilic, epileptic, degenerate, and insane.

# REVIEWS

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DENTAL ELECTROTHERAPEUTICS. By ERNEST STURRIDGE, L.D.S. England, D.D.S., Fellow Royal Society of Medicine; Member British Dental Association, London, England. Pp. 318; 154 engravings. Philadelphia and New York: Lea & Febiger, 1914.

THIS last of the series of small text-books on various phases of dental practice published by Lea & Febiger is a comprehensive treatise on electrotherapeutics. Inasmuch as the author believes that no one should employ this therapeutic agent without fundamental knowledge of electricity and electrophysics, the first half of the work gives a brief but satisfying discussion of the underlying principle of electric energy and the means of employing it. In this section is also included a description of the ordinary electric apparatus of the dental office, embracing all but the most recent additions to the dental outfit.

The chapter on *x*-rays describes the extensive field for the radiographic work in dental practice together with the technique for making radiographs. The author justly emphasizes the rapidly enlarging field of usefulness of *x*-rays in the diagnosis of the condition about the root apices of pulpless teeth and in ascertaining the direction of the root canals and the correct or insufficient filling of the same. His experience accords with that of the majority of practitioners who have employed it, for he considers the therapeutic value of *x*-rays limited in dentistry.

The most valuable therapeutic use of electricity recommended by the author is in ionic medication, in which field he is one of the pioneers. Testimony is gradually increasing as to the effective use of ionization in the germicidal treatment of many dental infections, and particularly in those low-grade peri-apical infections which yield so unsatisfactorily to other treatment. This with ionic medication of pockets about the teeth affected with pyorrhea alveolaris offers an additional valuable agent in the fight for the extermination of localized infections in the mouth, which are so generally recognized as the original foci of infections occurring in other portions of the body. Besides the germicidal action locally, the author suggests that the improved conditions may have resulted because "the dead organisms were absorbed into the blood stream

and had an effect upon the opsonins similar to that of vaccine prepared from cultures." For practitioners, the book may be recommended as a useful hand-book upon the subject of dental electricity, and should prove useful as a college text-book.

C. R. T.

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THE CLINICS OF JOHN B. MURPHY, M.D., at Mercy Hospital, Chicago. Vol. III, No. 1, February, 1914. Pp. 190; 91 illustrations. Philadelphia and London: W. B. Saunders Company, 1914.

THIS number opens the third volume of this popular periodical. It is prefaced by a note explaining that many of the cases referred to in the present number have already been reported in past numbers of the *Clinics*, and that the same can be said in regard to the skiagrams and photographs illustrating these cases; but their reappearance is accounted for by the fact that the patients or the figures illustrating their cases were shown by Dr. Murphy at the Clinics he held during the Clinical Congress of Surgeons last November. There is appended an advertisement of the days and hours of Dr. Murphy's Clinics at Mercy Hospital.

It might have been expected that Dr. Murphy would seize upon the present as an opportunity to assemble his clinical material and to report his operative results with more accuracy than has yet appeared; the reader is disappointed, however, to find that as he increaseth knowledge he increaseth sorrow, and that there is no new feature in Murphy's *Clinics*. The isolated cases reported almost uniformly show brilliant results; but in spite of the wealth of material there is no evidence of an attempt to allow the reader to draw a conclusion to the whole matter, by marshalling before him in orderly array facts on which his judgment may be based. Instead of this, there is endless repetition of catchy phrases and colloquial aphorisms, with Dr. Murphy's conclusions; but what the thoughtful reader desires now is to justify these conclusions in his own mind, and not to accept them on the unqualified ground of *ipse dixit*—especially when they are at war with popular beliefs.

There are several interesting addresses included in the present number of the *Clinics*, the most charming of which is that given by Sir Rickman Godlee (the editor calls him simply "Sir Godlee"), with the title "Lord Lister and Antiseptic Surgery." Of much interest also is Mr. Herbert Paterson's address on "Gastric Ulcer and Gastric Carcinoma."

A. P. C. A.

CASE HISTORIES IN PEDIATRICS. By JOHN LOVETT MORSE, A.M., M.D., Associate Professor of Pediatrics, Harvard Medical School; Associate Visiting Physician at the Infants' Hospital and the Children's Hospital, Boston. Second edition, 639; 200 case histories; freely illustrated. Boston: W. M. Leonard, 1913.

THIS book forms one of the "Case History Series" by Boston authors, which follow the very desirable precedent set by Dr. Cabot. They are intended as supplemental adjuncts to systematic textbooks. The subject of pediatrics in its most important aspects is well covered from the author's personal experience. The book begins with an introductory section upon the normal development and physical examinations of infants and children—a model of conciseness, yet fully comprehensive. The case histories, which form the bulk of the work, are divided into the more or less usual classifications: diseases of the newborn, diseases of the gastro-intestinal tract, etc. In each case the salient points of the history are first presented, followed by the results of careful physical examination. Up to this point no intimation is given as to the diagnosis except from the general heading, and the reader will find excellent opportunities for practice in inductive clinical reasoning. Then follows the author's diagnosis and the reasons therefor, with the prognosis and the treatment employed. By omitting all attempts at classification in the text and inserting the case histories in heterogeneous order, this slight aid to diagnosis would be denied and the reader's diagnostic acumen would be severely tested. The disadvantage of sacrificing all system could be obviated in the index, where the cases could be indicated by their special numbers and pages under proper classification for the use of those who desired to study this or that class of disease. In the preface, the author states that the diagnoses are correct in every instance in which they are stated with positiveness. As these comprise the great majority of cases, the objection to their unqualified acceptance is obviated. As a matter of record, a short note as to positive results—recovery, death, or whatever they may have been—would appear more convincing, since prefaces, unfortunately, are not always read. Throughout the book the didactic method of presentation is employed even to the point which at times might be considered unwarranted. The author's reasoning, however, is always logical, and were it not for the fact that human ills are not invariably subject to such treatment, no possible criticism could be made. On the other hand, he avoids *in toto* the most unsatisfactory and perhaps more dangerous habit of diagnostic vacillation. To the student, and even more to the practitioner of medicine, no more valuable accessory training in the subject of pediatrics could be recommended. J. C. G.

HISTORY OF MEDICINE. By FIELDING H. GARRISON, A.B., M.D., Principal Assistant Librarian, Surgeon-General's Library, Washington, D. C. 763 pp.; about 200 portraits. Philadelphia and London: W. B. Saunders Company, 1913.

THIS book is one of the most interesting and valuable of recent additions to medical literature, and meets adequately the demand that has long existed for a fuller one-volume history of medicine in English.

The author has given a scholarly and delightfully entertaining account of the development of medicine from the earliest times to the present year, with brief mention or longer sketches of about twenty-five hundred of the greater men of medicine. To the more important of these, he gives three or four pages of biography, and portraits of about two hundred. A feature of the book is the amount of space assigned to recent medical history, almost half the book being occupied with the nineteenth and twentieth centuries. Sketches of many of the men in this country and Europe at present most active in the advancement of medicine are here to be found. References to the literature are appended in footnotes throughout the work to the number of two or three thousand.

In an appendix are included a chronological table of 1700 important events in medicine, a critical review of other works on the history of medicine, the references to biographical sketches of one hundred of the most important men in medicine, and bibliographies of about sixty-five subjects related to the history of medicine. There is a complete index of all the personal names and all subjects mentioned in the text.

As a work of reference, this book is, of course, quite invaluable, and constitutes a mine of information; but it is more than this, for the author has presented his material so entertainingly that most delightful hours may be spent in reading the book from cover to cover.

J. H. A.

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PATHFINDERS IN MEDICINE. By VICTOR ROBINSON. Pp. 317; 16 illustrations. New York: Medical Reviews of Reviews.

IT is well for the medical profession that Victor Robinson overcame a hitherto generally "regarded psychological prejudice" against taking advice and yielded to the suggestion of his medical colleagues, to publish this present volume of biographical sketches. The latter, in part, have appeared in various medical periodicals, but as isolated essays they were doomed to extinction, if not oblivion, having been almost swallowed up in the torrential flood issuing continuously from the press. Published now for the first time in a

volume, these sketches are destined to become a familiar work in the physician's library and such should be their happy lot.

The biographies are arranged chronologically, beginning with Galen, ending with Darwin, and including Aretaeus, Paracelsus, Servetus, Vesalius, Paré, Scheele, Cavendish, Hunter, Jenner, Laennec, Simpson, Semmelweiss, Schleiden, and Schwann. They are for the most part admirably written and fascinating enough to beguile the working hours of many jealous minutes.

We liked especially the literary charm of the opening lines of "Servetus" and the pathos of the subsequent text; the stillness of night, where one "Might almost hear the sigh of all the sleepers in the world, and all the rivers running to the sea," is superbly painted as a background to the meeting with Vesalius. But all the sketches are well written and interesting even the one of Cavendish, of whom Robinson says "I defy any biographer to write an interesting sketch of Henry Cavendish." He seems to have picked up his own gauntlet.

We have now to censor the author for dedicating his volume both to the profession and to the public at large, for we deem certain lines questionable taste, even in these days of "Les Avariés" and like works. We mean the certain lines in Aretaeus, Paré, and the totally unnecessary liberty, (shall we say flippancy?) with which the author describes certain intimate details of Cavendish's existence. Were the book to end its days on the shelves of the doctor's sanctum, these lines might perhaps be understood, but we feel that since it is to be read by the general public the lines above mentioned are sure to be read as prurient stuff, for to the lay mind, they add nothing to the story except a little spice.

The volume is most enjoyable, and has the unique claim of presenting valuable information dressed in the best of literary cloth.

E. H. G.

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HUMAN PHYSIOLOGY. By Professor LUIGI LUCIANI, Director of the Physiological Institute of the Royal University of Rome. Translated by FRANCES A. WELBY. Edited by DR. M. CAMIS. With a preface by J. N. LANGLEY, F.R.S. In four volumes. Vol. II. Pp. 558; 141 illustrations. New York: The Macmillan Company.

THERE is need of a large work on physiology in the English language. The books of this type which are now in existence are ten or more years old and are in great need of revision. This translation is of value to the student whose interest in physiological problems is not restricted to the rather superficial consideration given to them in the average text-book.

The first chapter is devoted to the internal secretions which are treated in a most interesting manner. The chapter on the external digestive secretions is equally interesting. In passing it may be of interest to note that the author is not in sympathy with the theory of Bayliss and Starling concerning the function of secretin. These investigators believe that they found a hormone (internal secretion in the mucous membrane of the duodenum) which is able to excite pancreatic cells producing secretion of that gland in the normal animal. He presents considerable evidence to refute this theory which is at the present time generally held.

Digestion in the various regions of the alimentary canal is next considered and is followed by a chapter having the vague title of internal restitutive secretions and which includes a study of the complex processes by which the individual groups of foodstuffs are absorbed, stored and finally poured out into the blood to compensate for the losses following functional work and assimilation. The next is one of the most valuable chapters in the volume. It considers the intestine as an organ of excretion. The average student does not fully appreciate how much work has been done in showing how valuable the intestines are as organs of excretion, for the text-books do not give this subject sufficient consideration. The final chapters are on the excretion of urine and the functions of the skin.

The translator has done excellent work, the illustrations are good, and the references are brought up almost to the present. E. L.

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STOMATOLOGY IN GENERAL PRACTICE. A TEXT-BOOK OF DISEASES OF THE TEETH AND MOUTH FOR STUDENTS AND PRACTITIONERS. By H. P. PICKERILL, M.D., CH.B., M.D.S. (Birm.), L.D.S. (Eng.), Hon. Stomatologist to the General Hospital, Dunedin; Professor of Dentistry and Director of the Dental School in the University of Otago, etc. Pp. 268; 65 illustrations. London: Oxford University Press.

THERE is no region in the body that has been more neglected by the general medical practitioner than the mouth and its associated parts. This has been due in great measure to the development of dentistry as a separate profession. There is a wide field, including the inflammatory and other diseases of the soft tissues of the mouth and of the jaw bones, the manifestations of systemic diseases within the mouth, and the effects of oral disturbances upon the general system, that has not received sufficient attention either from medical men or dentists. Pickerill has covered the somewhat indefinite area included under

the head of stomatology, in an eminently concise and practical manner. The book is intended not so much for the specialist as for the general medical practitioner, and should be of almost daily service to the latter in his constant meeting with what he has hitherto regarded as obscure mouth conditions. Rational treatment of nearly all the oral lesions described is well within the power of the general practitioner. The original matter in the book includes the dietetic preventive treatment of dental caries, methods of treating pyorrhea alveolaris, a simple appliance for fixation of fragments in fracture of the jaws, and a method of recording examination of the teeth of school children.

Chapters VII and VIII, on the preventive treatment of dental caries, are the most important in the book, and form an epitome of what is perhaps the most valuable original work ever done on the subject.

In an otherwise excellent chapter on fractures we regret that the author does not mention fixation of the lower teeth to the upper with a metal intermaxillary splint for fractures posterior to the last molar. This method is unequalled for maintaining correct occlusion.

The author evidently has had little experience with ether anesthesia as practised in this country, as shown by his objection that "special apparatus" is required.

In an appendix are given numerous formulæ useful in the treatment of oral diseases, and also a list of simple dental instruments that should be in the cabinet of every general practitioner and hospital dispensary.

The book is almost a pioneer in a subject that we hope will gain before long the regular notice that it deserves from medical teachers and practitioners. R. H. I.

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THE PRESCRIBING OF SPECTACLES. By ARCHIBALD STANLEY PERCIVAL, M.A., M.B., B.C. (Cantab.), Senior Surgeon, Northumberland and Durham Eye Infirmary. Second edition. Pp. 168. Bristol: John Wright & Sons, Ltd. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd.

THE second paragraph of the optical section contains the statement, "I shall assume in this section that the reader is familiar with the elements of the subject." This sentence might appropriately have been placed at the beginning of the book, for the subject as here presented can only be grasped satisfactorily by a reader already acquainted with the principles of refraction. Most of the matter is, of course, common knowledge. The justification

for a restatement consists almost entirely in the manner of the presentation of which the first essential is clearness. In this respect there is little to be criticized, if the reader comes properly prepared, but it is not a book for the novice.

We note that the author prefers the concave to the plane mirror in retinoscopy; he recommends that I D be deducted from the total H found under atropin and about 0.75 D when homatropin is used. Allowance for range is not mentioned. Full correction of myopia is very properly recommended, as is also the fogging system in the subjective examination. The two-thirds rule is explained for the correction of presbyopia, which latter term the writer would do away with, holding that if it is used at all it should include acquired hypermetropia as well as defective accommodation. T. B. S.

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KLINISCHE BAKTERIOLOGIE UND PROTOZOENKUNDE. By DR. JULIUS CITRON, Assistenten der II Med. Klinik der Univ., Berlin. Pp. 172; 65 illustrations, 7 colored plates. Leipzig: Klinkhardt.

THIS small German manual gives in brief form a description of the common laboratory procedures in bacteriology and protozoölogy with a short description of the common organisms encountered. The illustrations, especially the colored plates, are rather diagrammatic. Bacteriologic technique (including staining methods, preparation of media, animal inoculation, securing of fluids for examination) is discussed, but only in barest outline so that the worker would search in vain for many minor details of considerable practical importance. Similarly in the discussion of the various organisms only the most important are considered and the description of these is brief. For those wishing a German manual this work would compare favorably with any of the smaller less pretentious works on the subject, but it has no advantage over many English manuals. J. H. A.

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A COURSE IN NORMAL HISTOLOGY. By RUDOLF KRAUSE, Professor of Anatomy at the University of Berlin. Translated from the German by Philipp J. R. Schmahl, M.D. 2 volumes; 86 pages, 406 pages; 30 illustrations and 98 colored plates, after drawings by the author. New York: Rebman Company, 1913.

THE German original of this book appeared in 1911, and was notable for its excellent illustrations in colors, and the author's

extensive use of the frozen section method as a routine class procedure in normal histology. In the translation, the work appears in two volumes; a smaller, devoted to microscopic technique, and a larger, in which the subject proper is taken up. The colored plates are the product of the original press, and are of the same excellence as in the German edition.

The volume on microscopy contains directions for all procedures necessary to study tissues. The descriptions are for the most part precise and lucid, and many hints of a practical nature show the first-hand experience of the author. The method followed in the second volume is to give descriptions of each plate independently, as in an atlas. These descriptions include not only the histological details seen in the illustrations, but also the method of preservation of each tissue, and its after-treatment. Of the 208 illustrations, 178 are from mammalian tissues, and about half of these are from human material. These include a comprehensive series of tissues, although the author has apparently thought it unnecessary to show the corpus luteum of the ovary, the Purkinje fibres and atrio-ventricular bundle of the heart, and the parathyroids, all of which are of great interest at the present time. Most of the sections were obtained by the freezing method, and stained by the Biondi solution, for the preparation of which very special directions are given. These and other departures from stereotyped methods give the work a considerable degree of originality, and make it an attractive exposition of the subject. W. H. F. A.

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LEITFADEN DER PRAKTISCHEN MEDIZIN, BD. 7, INNERE MEDIZIN. By GEORGE ZUELZER, M.D. Pp. 367. Leipzig: Dr. Werner Klinkhardt, 1913.

THE second and larger volume of Zuelzer's *Innere Medizin* completes the medical portion of Bockenheimer's series of hand-books, designed at a low price to cover the present status of the whole subject of Medicine.

The volume under reviewal covers in 346 pages the diseases of the digestive and urinary tracts, of the spleen, thyroid and blood, and diseases of metabolism. It is obvious, therefore, that the subjects can only be treated superficially and yet it is surprising to see how many facts can be condensed into such small space. Numerous laboratory tests are given in satisfactory detail; but symptomatology and diagnosis is often disposed of, perhaps necessarily, in a few, dogmatic sentences. Diseases of the spleen, for instance, are dismissed in one page, no mention being made of Banti's Disease or any type of primary splenomegaly. A complete and correct

index is a valuable feature. Frequently condensation has been carried to such an extent that treatment has been entirely omitted. It is difficult, therefore, to see the value of such a hand-book, which, from its many ommissions, becomes unsatisfactory for reference, and untrustworthy for study. As the "latest out" and at a low price, it might, however, have some vogue in Germany, but in this country this demand can be supplied in other and better ways.

E. B. K.

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Uber Laparo und Thorokoskopie. By H. C. Jacobaeus, M.D., Privat-dozent in Stockholm. Pp. 170; 5 tables and 1 illustration. Würzburg: Curt Kobitzsch, 1913.

Although Kelling as early as 1902 directed attention to the feasibility of examination of the closed body cavities, especially the peritoneal, by the use of electrically lighted instruments, the author of this monograph must be classed as the true pioneer from the stanpoint of modern practicability. He has divided his energy between examinations of the abdominal and thoracic cavities, and after detailing the technique, which is very simple to one at all familiar with endoscopy, states the indications for the procedure, claiming that not infrequently the method could and should be adopted for the exact diagnosis of obscure or uncertain pathological lesions of the abdomen and thorax. The author narrates in detail the histories and findings in 140 cases examined in this manner, and has succeeded in establishing the differential diagnoses in the following conditions: cirrhosis of the liver, Pick's disease, syphilitic liver, congestion of the liver, tuberculous peritonitis, abdominal tumors, acute and chronic exudative pleuritis, thoracic empyema, and artificial pneumothorax. The work is supplemented by tables showing very excellent photographic and colored drawings of the pathological structures studied.

B. A. T.

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Diseases of Women. By Thomas George Stevens, M.D., B.S., F.R.C.S., M.R.C.P., Obstetric Surgeon, with charge of out-patients, St. Mary's Hospital, Paddington. Pp. 431; 202 illustrations. London: University of London Press.

In this book Dr. Stevens has given us his ideas based upon ten years' experience as a clinician and a teacher of gynecology. The subject matter has been classified according to a compromise between clinical manifestations and purely pathological processes.

The later theories of the physiology of menstruation and the disorders of this function are given fully. Here as throughout the book all controversial points are impartially discussed.

A section is devoted to the anomalies of pregnancy, the pathological results of which are commonly met with in gynecological practice. An interesting and helpful chapter is included on the general conditions associated with pelvic disorders and the relation of these conditions to gynecological diagnosis.

Newgrowths of the generative system are considered at length. The author mentions but does not recommend *x*-ray or radium therapy in the treatment of fibroid tumors of the uterus. The advantages and the technique of the Wertheim Operation for carcinoma of the cervix are concisely presented. The necessity of a thorough pelvic examination for the early diagnosis of possible malignant disease in cases of irregular uterine hemorrhage is emphasized.

The author concludes with short but complete chapters on the preparation of patients, the after-treatment, and postoperative complications of gynecological conditions.

The book contains a minimum of typographical errors, and it should meet with no small measure of popularity. P. F. W.

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DIE GOLDSCHMIDTSCHE IRRIGATIONS-URETHROSKOPIE. By DR. A. SCHLENZKA. Pp. 99; 24 illustrations and 12 tables (6 in color). Leipzig: Dr. Werner Klinkhardt.

IN this masterfully composed little book the author has paid an appropriate literary tribute to the memory of his teacher, Dr. H. Goldschmidt, of Berlin, the father of "irrigation urethroscopy." It is doubtful if Goldschmidt himself could have presented a more complete, systematized, and summary exposition of his crowning life-work.

The author briefly reviews the development of urethroscopy, delineating the improvements in construction of anterior, posterior, and combined urethroscopes, including the urethrocystoscope. The technique of examination is carefully considered and the appearance of the normal and pathological urethra accurately described. The cuts illustrate well the parts and mechanism of the Goldschmidt instruments, and the plates, six of which are in color, at the end of the monograph, amply and satisfactorily, represent the various views of the urethra in health and disease.

The final chapters are devoted to a consideration of operative treatment, including instillation, electrolysis, ignipuncture, cauterization, and prostatic incisions, for the performance of which the Goldschmidt urethroscope is well equipped and adapted.

B. A. T.

A DICTIONARY OF MEDICAL DIAGNOSIS. By HENRY LAWRENCE MCKISACK, M.D., M.R.C.P., London; Physician to the Royal Victoria Hospital, Belfast. Second edition. Pp. 590; 76 illustrations. New York: William Wood & Co.

THE first edition of this book appeared in 1907. Since then there have been numerous advances made in the science of diagnosis. The description of many of the newer signs, reactions, and tests has been incorporated in the present edition. The general character and scope of the book is unchanged. The various symptoms and physical signs occurring in disease are arranged in alphabetical order. The list also includes descriptions of the more usual laboratory methods of diagnosis, of *x*-ray diagnosis, and of a few of the many instrumental methods that may be employed in determining the cause of disease. In the last category no mention is made of the findings achieved by the use of such valuable instruments of diagnosis as the electro-cardiograph in heart disease, the cystoscope in diseases of the genito-urinary tract, and the proctoscope in diseases of the lower portion of the alimentary canal. The gastroscope is dismissed as worthless and the bronchoscope not mentioned at all.

For the most part the description of the various symptoms and signs are concise but clear and complete. Criticism might be made of the author's classification of the various arrhythmias and particularly might fault be found with the omission of any mention of auricular fibrillation. The sections on examination of the blood, sputum, and urine are most commendable. In general the book will be found useful for quick superficial review and for reference.

J. H. M., JR.

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TEXT-BOOK FOR NURSES: ANATOMY, PHYSIOLOGY, SURGERY, AND MEDICINE. By E. W. HEY GROVES, M.S., F.R.C.S., Assistant Surgeon, Bristol General Hospital, and J. M. FORTESCUE-BRICKDALE, M.A., M.D., Assistant Physician, Bristol Royal Infirmary. Pp. 407; 205 illustrations. London: Oxford University Press.

IN presenting this text-book for the use of nurses the authors have taken a long step forward in making possible the standardization of nursing knowledge and efficiency. It is in no sense a hand-book on nursing. No attempt is made to tell *how* details are to be executed, the whole emphasis is laid on *why* such measures are necessary. The aim is to arouse the intelligence of the nurse and make her work a conscious scientific effort.

The foundation which makes this possible is the section on anatomy and physiology. The section on surgery is wisely opened

with a concise review of the principles of bacteriology and the relation of microörganisms to disease. The main field of general surgery is covered, and symptoms reduced to a physiological and anatomical basis. The section on medicine covers the subject in a brief and satisfactory way. The care taken in the preparation of this book is evident throughout.

A. A. H.

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THE EVIL EYE, THANATOLOGY AND OTHER ESSAYS. By ROSWELL PARK, M.D., LL.D. (Yale). Pp. 380. Boston: Richard G. Badger, The Gorham Press.

ALL lovers of history and students of essays will heartily welcome the publication of this series of essays by Rosewell Park. Thirteen in all, they cover subjects of wide range, dealing with mythology; studies of signs and symbols; the foundation of Christianity and its relation to the Grecian mysteries; the relation of the Church to medicine; a critical but speculative inquiry into the mystery of death; biographical sketches of famous men; and several essays covering in interesting fashion certain historical aspects of medicine.

Possessed of a facile pen, an ease of expression, coupled with his wealth of knowledge the author has undoubtedly created an enviable niche for himself in the field of literary endeavor.

B. B. V. L.

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ESSAYS ON GENITO-URINARY SUBJECTS. By J. BAYARD CLARK, M.D., Assistant Genito-urinary Surgeon to Bellevue Hospital. Pp. 174. New York: William Wood & Company.

THE author has presented ten short chapters on variously chosen subjects of genito-urinary interest. About one-half of the contents is composed of previously read and published papers, some as far back as seven years, each chapter so constituted bearing supplementary notes in an attempt to bring it up to date. As a whole, the subject matter is not without interest, but the object of the presentation is not clear, since to students or those unfamiliar with genito-urinary knowledge, the cursory manner of the essayist will convey little of fundamental value, while to the skilled clinician, the incompleteness of the subjects treated stands out prominently, adding not only nothing new, but omitting certain considerations of importance.

In discussing the diagnostic advantages of the cystoscope, the essayist slights a number of vesical conditions, among them tuberculosis, claiming that they are not to be included in "affections ordinarily requiring surgical intervention."

The author elects to base functional kidney diagnosis on ureteral catheterization, an act occasionally impossible of accomplishment. He ignores absolutely the kidney test by indigocarmin, whereby the functional sufficiency of the kidney may be gauged when it will be impossible by any test dependent upon bilateral ureteral catheterization. Moreover, the phloridzin test, which is recommended, has been proved to be unreliable, no glycosuria occurring even from normal kidneys.

Exception may also be taken, rightfully, as to the advisability of catheterizing the supposedly normal ureter through a bladder infected by descending tuberculosis of the other side. Likewise the urine separator or segregator has today few advocates. Other doctrines are seriously questionable, as for example, in addition to massage, the treatment of chronic prostatitis by such measures as electricity and the mechanical application of heat and cold.

B. A. T.

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THE SEXUAL LIFE OF THE CHILD. By ALBERT MOLL, M.D. Translated from the German by EDEN PAUL, M.D. Pp. 339. New York: The Macmillan Company.

THE translation of this work, coming as it does, at a time when such general interest is being taken in eugenics, promises to fill a want felt until now in the preparation for this field of activity.

The author points out that the rational solution of the problems of eugenics must be based on fact and that this definite knowledge, in so far as the normal sexual life of the child, at least, is concerned, has as yet been neglected. The subject is then put before the reader in a systematic and comprehensive way. Every physician, teacher, parent, and social worker should have the information contained in this book at his disposal.

A. A. H.

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SEX—ITS ORIGIN AND DETERMINATION. By THOMAS E. REED, M.D. Pp. 313. New York: Rebman Company, 1913.

HAD this book appeared a decade ago, it would have received more attention than at the present day. The observations contained therein were first stimulated by the remarks of Darwin, that, as all present-day animals are descended originally from tide-water organisms, there might exist cycles in some of our life processes, which could be looked upon as the persisting effect of these tidal movements. The author believes that he can trace this effect in, among other phenomena, the "functional phases" of parturition and the alternating male and female phases of the ova, which, as

he believes lead to the determination of sex. To refer more specifically to the latter, he says that if the ovum is fertilized during the ebb of the tide, the offspring will be of one sex, and if during the flow of the tide, of the other sex. Moreover, he assures us that his observations bear out his contention.

On the other hand, the evidence is rapidly accumulating that the chromosomal dimorphism of the spermatozoa is the factor upon which sex determination depends, and a recent paper by Wodsedalek in the *Biological Bulletin* gives good evidence that somatic cells of the male and female have likewise different chromosomal constitutions. In view of these developments many of the ideas contained in this volume must be considered as of merely historical interest. W. H. F. A.

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BACTERIA. By DR. MAX SCHOTTELIUS, second edition translated by Staff Surgeon HERBERT GEOGHEGAN, R. N. Pp. 324; 10 colored plates and 33 illustrations. London: Oxford University Press and Hodder and Stoughton.

THE present volume represents the translation of the second edition of a previous popular work on bacteria. In this edition the text has been thoroughly revised and the inaccuracies of the first edition corrected. The chapters on "Immunity and Protective Vaccination" and "Protozoa" have been rewritten and enlarged to meet the modern views on these subjects. The work suffers the fault of many translations in being a little verbose and drawn out, but force and clearness are not sacrificed. The discussions are in more or less popular terms, so as to be clearly intelligible to the lay reader. The book, however, is intended for the physician or student of bacteriology, and will give to either a very good general idea of bacteria, their universal distribution in and their relation to various natural processes; it further treats of the manner of action of bacteria in disease with the possibilities and methods of combating diseases caused by them. F. H. K.

# PROGRESS

OF

# MEDICAL SCIENCE

## MEDICINE

UNDER THE CHARGE OF

W. S. THAYER, M.D.,

PROFESSOR OF CLINICAL MEDICINE, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND,

AND

ROGER S. MORRIS, M.D.,

CHIEF OF THE DEPARTMENT OF INTERNAL MEDICINE, CLIFTON SPRINGS SANATORIUM AND HOSPITAL, CLIFTON SPRINGS, NEW YORK.

**On the Quantity of Glucose in the Blood in Health and Disease.**—B. PURJESZ (*Wien. klin. Woch.*, 1913, xxvi, 1420) has made a number of quantitative determinations of glucose in the blood in health and in various diseases. He finds that it varies between 0.0451 and 0.087 gm. per cent. in health, the blood being taken from the cubital vein in the morning, before food has been taken into the stomach. The normal variation is considerable, but, given like conditions in one and the same individual, there is little change in the quantity of sugar. Normally, the greater part of the blood sugar is in the plasma; only a trace is found in the erythrocytes. During febrile periods, the sugar in the red corpuscles may be increased. With increased activity of the thyroid gland, the quantity of glucose in the blood is small. Subcutaneous administration of the infundibular portion of the pituitary body in normal individuals increases the blood sugar. In Addison's disease, the sugar in the blood was found to be low. In the cases with hypertension examined, there was found a hyperglycemia. In pneumonia, fever was accompanied by hyperglycemia, though the latter was lacking in miliary tuberculosis and typhoid fever. Purjesz believes there is a fairly constant association of hyperglycemia with hypertension and fever.

**Diabetes Insipidus and the Pituitary Gland.**—M. SIMMONDS (*Münch. Med. Woch.*, 1913, lx, 127) reports an instructive case of diabetes insipidus. The patient, a woman of thirty-seven years of age, was operated on for cancer of the breast. She made a good recovery from the operation. The urine at this time averaged about 1500 c.c. daily, with specific gravity 1.012 to 1.015. Ten weeks after the operation,

the patient returned to the clinic and reported that for two weeks she had had marked polyuria and increase thirst. The urine varied in amount between 10 and 19 liters, the specific gravity between 1.002 and 1.003; there was neither sugar nor albumin. The patient suffered from extensive metastases and finally died three months after the operation. Autopsy revealed metastases in the skin, breast, liver, cervical, pectoral, and abdominal lymphatic glands, pleura, and vertebræ. The kidneys were normal. The cerebrum, cerebellum, and medulla were also normal; there was no enlargement of the ventricles of the brain. The posterior aspect of the sella turcica felt soft, and so the entire sella and pituitary gland were removed *en masse*. After decalcification, sections were prepared. Microscopic examination showed a metastasis involving the bone and the adjacent posterior lobe of the pituitary body. As Schäfer has shown that the anterior lobe has no diuretic properties, Simmonds explains the polyuria through stimulation of the pars intermedia by the presence of the malignant growth in the posterior lobe, which had been completely destroyed.

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**Eosinophilia in Carcinomatosis and in Lymphogranuloma.**—R. STRISOWER (*Wien. klin. Woch.*, 1913, xxvi, 16) reports an eosinophilia which at one time amounted to 45.3 per cent. with total white count of 15,000 in a patient suffering with carcinomatosis, the result of primary uterine cancer. The red-blood corpuscles were 4,700,000, the hemoglobin 60 per cent. No nucleated red cells were found in the blood. Neither clinical study nor autopsy revealed any of the usual causes of esoinophilia. There were metastases in the sternum, and the marrow here was loaded with eosinophile cells. In a case of lymphogranulomatosis (Paltauf-Sternberg), an eosinophilia of 42.6 per cent. with total white count of 28,900 was observed. In this case there was a marked anemia, the red cells numbering 1,890,000, hemoglobin 35 per cent. A few erythroblasts were found. Autopsy showed great enlargement of the glands of the left side of the neck, also of the mediastinal, retroperitoneal, mesenteric and inguinal regions, with metastases the size of a bean to that of a cherry in spleen, liver, right adrenal, and bone-marrow. An excess of eosinophiles was found only in the bone-marrow.

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**On the Absorption Spectrum of Phenolphthalein.**—B. BARDACH (*Wien. klin. Woch.*, 1913, xxvi, 141) has found that phenolphthalein in the urine, in amounts such as may occur after the administration of the drug as a laxative, may give rise to a single rather broad band in the spectrum situated about midway between D and E. As little as 0.004 gm. per liter of urine may give rise to the spectrum. In examining for the band, 0.5 c.c. of 15 per cent. sodium hydrate is added to 10 c.c. of urine. This is placed in a test tube 3 cm. in diameter and examined. The specimen should be examined while fresh, as the dye may disappear after a short exposure to the air. It is apparent that very small amounts of phenolphthalein may be detected in the urine—so small, in fact, that the color of the drug cannot be detected in the presence of the urinary pigments. The spectrum of phenolphthalein should be borne in mind in examining the urine for blood or urobilin. Reduced hemoglobin has a very similar spectrum. To differentiate

between urobilin and phenolphthalein, add a few drops of hydrochloric acid to the specimen and reëxamine. The spectrum of phenolphthalein is not seen in acid urine.

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**On the Partition of Cholesterin, Cholesterin Esters, and Lecithin in the Blood.**—M. BUERGER and BEUMER (*Berlin. klin. Woch.*, 1913, l, 112) have made quantitative determinations of the free cholesterin, cholesterin ester, and lecithin in the blood serum in a number of diseases. They have apparently established the fact that free cholesterin is always present, though the proportion of total cholesterin which is free is variable. As a rule, free cholesterin amounts to at least 30 per cent. of the total. The highest value, 2.469 gm. per liter of serum, was found in severe cholemia, though high values were also encountered in diabetes with lipemia. Buerger and Beumer were unable to confirm the view expressed by Rohmann to the effect that sera rich in free cholesterin give a positive Wassermann reaction. In some cases with excessive amounts of free cholesterin, the Wassermann reaction was negative. As a rule, the quantity of lecithin parallels that of cholesterin. Here, too, it was found that a high lecithin content does not necessarily mean a positive Wassermann reaction.

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**The Dietetic Therapy of Urticaria.**—H. SALMON (*Wien. klin. Woch.*, 1913, xxvi, 1399) has had excellent results with the dietetic therapy of chronic urticaria. He has never been able to convince himself of the value of calcium salts in the treatment of this condition; with the injection of normal human serum he has had no experience. The diet which Salmon has devised is poor in protein, as it is presumed that the urticaria is an anaphylactic phenomenon. Its frequent occurrence after eating lobster, cheese, eggs, strawberries, etc., is well known. The diet consists of tea or coffee with plenty of sugar, bouillon, lemon or grape juice, brown bread (schrotbrot) about 200 gm. with a liberal allowance of butter, rice, "Griess," barley, oatmeal, etc. (no legumens), cooked in bouillon or water with butter in abundance, green vegetables prepared like the cereals, potatoes, fresh or cooked fruits. This diet, the caloric value of which is enhanced by butter and sugar, is estimated to contain about 35 to 40 gm. of protein, a considerable portion of which is not absorbed. The urticarial eruption subsides strikingly, as a rule, after the second or third day of the protein-poor diet. Generally, it subsides entirely within the fourteen days during which the diet is continued. Usually, eggs, cheese, milk, and meats may now be added to the diet gradually without a recurrence of the urticaria.

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**On the Significance of Abderhalden's Serum Reaction in Psychiatry.**—W. MAYER (*Münch. med. Woch.*, 1913, lx, 2044) reports his observations on Abderhalden's ferment reactions in a small series of psychitric cases. He feels that paradoxical results are due to faulty technique. The serum of patients suffering with dementia præcox always contains a specific enzyme for the sexual gland (ovary or testis, according to the sex of the patient) and usually enzymes acting upon the cerebral cortex and the thyroid gland. In the group of functional psychoses, no specific ferments could be found in the blood serum—

a point which may prove to be of value in the differential diagnosis of dementia præcox and manic depressive insanity. Sera from general paretics contain a group of specific enzymes as a rule; there is always an enzyme which acts specifically upon the brain and usually enzymes for the sexual glands and liver, often for the thyroid as well. Thus, the only difference found between the sera of the paralytic and the patient with dementia præcox has been the presence of the liver enzyme in the former. Mayer believes the method is one which may prove valuable in psychiatry.

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**On Complement Fixation in the Cerebrospinal Fluid of Patients Suffering with Carcinoma.**—v. DUNGERN and HALPERN (*Münch. med. Woch.*, 1913, lx, 1923) allude to the fact that in luetics complement fixation may be present in the cerebrospinal fluid, when the blood is negative. Drefus and Almann, indeed, have shown that such may be the case even in the early stages of the infection, when no clinical symptoms are manifest. Since complement fixation may be present in the sera of patients ill with malignant disease when certain antigens are employed, it becomes important to study the cerebrospinal fluid of such patients to determine whether it is capable of binding complement. As antigen, Dungern and Halpern used the acetone extract of the red blood corpuscles of a paralytic and also heart extract. Cerebrospinal fluid was used in amounts of 0.4 to 0.05 c.c. Bloody fluids were discarded. In many of the very cachectic patients it was thought unwise to remove the fluid, so that the number of observations was somewhat limited. The cerebrospinal fluid of 29 patients suffering with various diseases was studied; included in this number were 5 patients with cancer not affecting the central nervous system and a number of syphilitics. The reaction was positive in the cases of cancer, negative in all other diseases examined except lues. By means of the heart extract antigen, it was possible to differentiate the cancerous and luetic fluids, for it was found that the luetic fluids gave positive reactions with both heart extract and blood extract as antigens, while the cancerous fluids were all negative when heart extract was used as antigen but positive with the blood extract.

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**On the Specificity of the Protective Enzymes (Abwehrfermente).**—E. ABDERHALDEN and E. SCHIFF (*Münch. med. Woch.*, 1913, lx, 1923) have examined an immense number of sera from pregnant women and pregnant animals. Whenever the opportunity has presented itself, they have tested for specific enzymes against other organs than the placenta. In 105 cases liver has been tested, in 30 thyroid. With exact technique, they have found the reaction to be specific. Recently, Heilner and Petri have denied the specificity of the reaction. They find that in the case of hematomas all possible organs are digested. Abderhalden and Schiff have studied a number of cases of hematoma. When blood-containing organs were employed, digestion always occurred, but when blood-free organs were substituted, the reaction was always negative. Recently they have found that the serum from a patient suffering from crushing of the muscles and hematoma had no effect on liver or placenta but reacted positively with muscle tissue and blood.

**Papaverin as an Aid in the Röntgenologic Differentiation of Spasm and Organic Stenosis of the Pylorus.**—G. HOLZKNECHT and M. SGALITZER (*Münch. med. Woch.*, 1913, lx, 1989) refer to the difficulty of determining whether defective gastric motility is due to spasm or to organic stenosis of the pylorus. The duration of the retention is not sufficient; they have observed 2 patients with spasm (proved at operation), where part of the bismuth meal remained in the stomach at the end of twenty-four hours. It has been shown by Pal and others that papaverin diminishes or abolishes the tonus of smooth musculature, both circular and longitudinal. Its effect is much less marked with normal than with pathologically increased tonus. Peristalsis, however, is unaffected. Holzknecht and Sgalitzer have used this drug in connection with their röntgenologic studies of the pylorus. In case pyloric obstruction is found, the examination is repeated, and the second time they administer 0.05 to 0.07 gm. of papaverin hydrochloride *per os* one hour before giving the bismuth meal. In a normal stomach the time of emptying is reduced to one-fourth or one-third the normal. Of 25 stomachs which showed remains of the bismuth meal at the end of six hours, papaverin resulted in lengthening the time in 7, diminishing the time in 6, while there was no changes in 12. Of the 7 cases of the first group (stenosis), 3 have been operated. In only 1 of the second group was an operation performed; here a duodenal ulcer with spasm of the pylorus was found. In those cases where the time of empyting is unaffected, it is believed that spasm and organic stricture co-exist.

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**Abderhalden's Test in Diseases of the Thyroid Gland.**—A. E. LAMPÉ and R. F. FUCHS (*Münch. med. Woch.*, 1913, lx, 2112, 2177) have examined the sera of 60 patients, a few of whom were included in a previous report; all were suffering with disease of the thyroid gland. The sera were tested for specific enzymes according to Abderhalden's method; various organs were used. The material in the present report included 12 cases of Basedow's disease, 11 cases of incomplete or suspected Basedow's disease, 2 of myxedema, and 11 with endemic goitre. Lampé and Fuchs find that the serum of a patient with Basedow's disease always contains an enzyme which is specific for a Basedow thyroid gland and, in a few cases, an enzyme for normal thyroid gland. At the same time there are present in the majority of cases enzymes which attack the thymus and the sexual glands. In the *formes frustes* the same conditions are found. In the sera of two myxedematous patients a specific enzyme for thyroid tissue was also found. Likewise, in endemic goitre the Abderhalden reaction is positive with thyroid gland. The reaction is found to be absolutely a specific one, if the proper care in technique is observed.

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**Retrohepatic Dulness as a Sign of Typhoid Fever.**—In 1911 Lesieur emphasized dulness at the right base as a very convenient and frequent sign of typhoid fever. In the course of the disease, on superficial percussion over the right base of the chest, one can nearly always determine a definite area of dulness, not present on the left, and not explained by pleural or pulmonary lesions. LESIEUR and MARCHAND (*La Presse Méd.*, 1913, p. 625) have sought the sign in 150 patients

under their observation; 114 of these had typhoid fever with positive bacteriologic tests. The retrohepatic dulness was present in 87 (80 per cent.), and absent in 27. Its absence is accounted for by the stage of the disease. It disappears usually toward the approach of convalescence. No one of the negative cases was seen before the twentieth day. In 17 abortive cases the sign was present in 50 per cent. But in no case of any other character was the sign positive. It is uniformly negative in all other infectious diseases. The prognostic value of the sign lies in the fact that its disappearance practically announces the onset of the defervescence. Its reappearance, or its persistence after the fall in temperature is indicative of probable relapse. Lesieur and Marchand believe the sign can be explained by increase in the volume of the liver, due, at least in many cases, to congestion. The variations in the intensity of the sign support this. Lesieur and Marchand hope to determine the pathological explanation more certainly by radioscopy.

## SURGERY

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

FORMERLY JOHN RHEA BARTON PROFESSOR OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA AND SURGEON TO THE UNIVERSITY HOSPITAL,

AND

T. TURNER THOMAS, M.D.,

ASSOCIATE PROFESSOR OF APPLIED ANATOMY AND ASSOCIATE IN SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE PHILADELPHIA GENERAL HOSPITAL AND ASSISTANT SURGEON TO THE UNIVERSITY HOSPITAL.

**Splenic Anemia with Special Reference to Etiology and Surgical Treatment.**—RODMAN and WILLARD (*Annals of Surgery*, 1913, lviii, 601), as the result of a study of the literature and experimental work on dogs, say that splenic anemia is a disease entity characterized by a definite symptomatology and pathological picture, and the so-called "Banti's disease" is its terminal stage. In all probability the primary cause of splenic anemia is a toxemia, the origin of which is to be sought for outside the spleen itself, possibly in the gastro-intestinal tract, but the exact nature of which is unknown. This toxin probably acts primarily or secondarily on splenic cells, causing an hypertrophy and increased activity. This increased splenic activity is responsible for the anemia probably through a decreased resistance of the red blood corpuscles. The icteric pigmentation is also due to an increased hemolysis. Although the thrombophlebitis of the splenic and portal veins is a frequent finding, clinically, they believe, from their own experimental work and that of others, that it is not an essential factor in the etiology. If the theory of a primary toxin is correct, they suggest that the blood coming from the spleen to the liver should be doubly toxic in that it contains not only the primary toxin, but that

also elaborated by the splenic substance. To their minds it is the action of this doubly toxic blood that causes the endophlebitis of the splenic and portal veins with consequent thrombosis. In all probability these same toxic factors play the important role in the production of liver cirrhosis, although the mechanical factor of congestion of the portal system may be an additional cause. Up to the present time treatment other than surgical has yielded only temporary benefit. Splenectomy in the first and second stages offers us our only chance of a permanent cure. The mortality is 12.5 per cent. Splenectomy in the third stage will arrest the further development of the disease, but will not cause a retrogression of the liver cirrhosis. In a few isolated cases of early cirrhosis permanent cure has followed removal of the spleen. In the past five years the mortality following splenectomy when done in the third stage has been 56¼ per cent. The combination of splenectomy and Talma's operation should be the procedure of choice in this stage.

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**Nephrostomy: A Permanent or Temporary Means of Delivering all the Urine.**—Pakowski (*Jour. d'Urology*, 1913, iv, 373 and 579), quoting Albarram, describes a nephrostomy as an operation for creating a renal cutaneous fistula. This fistula passes through the kidney substance to the pelvis. Pakowski says that all the anastomoses of the ureter to the vagina, the urethra, or the intestine, lead sooner or later to pyelonephritis. Ureterostomy alone can be compared with nephrostomy. It is a more benign operation than nephrostomy. It has the following objections: Drainage is less certain than from the kidney by a nephrostomy, because of the possibility of renal retention from ascending ureteritis or other occlusion and the impossibility of reëstablishing the normal course of urine into the bladder or into a new-formed vesical cavity. The objection that can be made to nephrostomy is that it exposes the kidney to the danger of nephritis from time to time or occasionally to the danger of hemorrhage, and on the other hand, it creates a fistula which necessitates the carrying of an apparatus. This last objection applies as much to ureterostomy as to nephrostomy. But the fistula is an inconvenience which can be tolerated. With a good apparatus, and they are numerous, the patients lead perfectly normal lives. They do not carry about a urinous odor. They report the histories of two cases. Both are of men of the world, living a very active life, travelling, hunting, and going about in the world, without any inconvenience. Laying aside the irksomeness of the fistula, nephrostomy presents the following advantages: (1) The opportunity of attacking the renal lesions which made the nephrostomy necessary; (2) the possibility of reëstablishing finally the normal course of the urine, if this is considered advisable; and (3) especially the excellent drainage provided by the nephrostomy, drainage which absolutely prevents pyonephrosis and even the reproduction of calculi. The mortality was 4.5 per cent., and in the majority of operated cases, death was due not to the nephrostomy but to the affection calling for the operation. The mortality in all the other methods of of operation is greater. The indications for nephrostomy are multiple: (*a*) In acquired affections of the bladder; malignant tumors, grave tuberculous cystitis, painful and rebellious cystitis. According to the necessity it will be permanent or temporary in (*b*) congenital affec-

tions of the bladder; exstrophy, absence of sphincter. In these cases it creates for the first time a new reservoir. (*c*) It is indicated in affections of the pelvic organs which have invaded the bladder or compressed the ureter, such as cancer of the uterus and cancer of the prostate; (*d*) in traumatic lesions of the bladder or ureter, rebellious vesicovaginal fistula, in particular. (In these cases the nephrostomy opening is maintained only during the repair of the lesions); (*e*) in certain cases of renal lithiasis, nephrostomy is the only means of preventing the tendency to continuous recurrence of calculi.

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**One Hundred and Eighteen Cases of Empyema Treated by Operation.**—HIRANO (*Deutsch. Zeit. f. Chir.*, 1913, cxxiv, 507) says that while he was not the operator in all these cases, he assisted in all those in which he was not the operator and watched the aftercourse and observed the results in all. One-seventeenth of the cases of empyema developed in adults from serous pleurisy, and two-thirds of those in children. Of the 118 empyemas, 93 were in children from infancy to fifteen years of age. Of 328 cases of pleurisy in adults, 18 were purulent; and of 66 in children, 41 were purulent. Of the 25 cases of serous pleurisy in children, the earliest developed after seven years of age. Of the 118 cases of empyema, 71 were on the right side and 47 on the left side. Hirano saw 2 cases of double empyema in the last two years. In these the empyema developed first on the right side, and after about two weeks on the left side. The majority of his cases were primary, 13 of those in adults and 64 of those in children. Most of the secondary cases in adults developed from serous pleurisy, in children from croupous pneumonia. In 40 per cent. of the cases the pneumococcus was found, in 13 per cent. the staphylococcus and streptococcus. More rarely colon bacilli and pneumobacilli, as well as putrifactive bacilli were found in the pus, but never the tubercle bacilli. In 32 per cent. of the cases no bacteria were found. In only 3 of the bacteria-free cases did animal experimentation show tuberculosis. In many of them the history and symptoms showed probably croupous pneumonia. The period intervening between the beginning of the disease and operation in the adult was: one month in 8 cases, two to five months in 13, and half a year to a year in 4. In children it was: one week in 10 cases, two to three weeks in 30, four to five weeks in 24, six to nine weeks in 23, and ten to thirteen weeks in 6. Six years after complete healing in one child, another empyema developed on the same side and was operated on. The results of operation in the adults were bad. Twelve patients died, a mortality of about 50 per cent. Only 8 cases remained permanently healed. Sixty-seven of the children are still sound (72 per cent.) and 14 have died since the operation (14 per cent.). Of the remaining 5 adults and 12 children, no news was obtained. In the 8 healed adult cases at least half a year was necessary for good cicatrization of the wound. In 4 cases, after resection of one rib, further resection of ribs was necessary. One fourth of the cases in children were healed in three weeks, half of them in four to five weeks, and in the remaining cases six to seven weeks were necessary. Two recovered after two to four months. In his earlier cases Hirano employed gauze drainage, but later used the rubber tube with a gauze strip in the tube.

**The Surgical Treatment of Ascites.** — SCHWARZMANN (*Deutsch. Zeitsch. f. Chir.*, 1913, cxxiv, 546) reports 14 cases of ascites operated on between 1906 and 1912 and presents a study of the subject. In 2 of his cases (1 and 2) a simple omentopexy was performed. In 4 (4 to 6), the omentum was fixed in a preperitoneal pouch, and in 2 (7 and 8), in a subcutaneous pouch. In 4 (9 to 12), the spleen was fixed in a preperitoneal pouch and an omentopexy was added. In 1 case (13) the left lobe of the liver and omentum were fixed, and in another (14) an omentopexy was done plus a double saphenopexy. The latter operation consists in anastomosing the saphenous vein with the peritoneal cavity. The results of the operations may be summarized as follows: In the first case death occurred 47 days after operation, but no autopsy was done. In the second case (tuberculosis of the abdomen with marked liver cirrhosis), death occurred thirteen months after operation. In the third case there followed a paralysis of the intestines, and autopsy, five days after operation, showed degeneration of the heart muscle. Since there was a severe jaundice and much blood in the stomach and intestines, cholemia must have played an important role. In the fourth case there was tuberculous peritonitis with ascites, and marked liver cirrhosis. The operation was done under local anesthesia and resulted in a much improved condition of the patient. She is still living and fully able to work. In Case 5 there was calcification of the pericardium and heart, mitral insufficiency, and a small cirrhotic liver. The omentum was thickened and already adherent to the parietal peritoneum. No improvement followed the operation. In Case 6 the patient was almost completely bedridden, with marked ascites and tricuspid insufficiency. The operative result was excellent, as she, eight months after operation, is able to do her work and her general condition is very much improved. In Case 7 (alcoholic cirrhosis), the patient died of peritonitis due to a suture deficiency and fistula, from which the ascitic fluid escaped. Case 8 (alcoholic cirrhosis) is completely cured and is one of the best of the cases. It speaks for the subcutaneous fixation of the omentum. Case 9 (alcoholic cirrhosis) became completely able to work and had no more ascites after operation. He died two years after operation from a "heart attack." Case 10 (alcoholic cirrhosis), had severe albuminuria. The peritoneal cavity was drained by gauze. The autopsy showed severe parenchymatous nephritis, calcification of the heart, and beginning pneumonia. In Case 11 an intercurrent hemorrhagic, fibrinous pericarditis, four and one-half months after operation, caused death. Case 12, a girl, aged twenty-three years, had an omentopexy done on her in 1907, for ascites. No improvement followed, and a year later the spleen was fixed subcutaneously with considerable improvement. Case 13 was a confirmed alcoholic, had an aortic, systolic murmur, enlarged heart, and general arteriosclerosis. An omentopexy in a preperitoneal pouch was followed by death three months later. In Case 14 an omentopexy and a double saphenopexy were performed. In the latter operation the saphenous vein was ligated about 8 cm. from its termination and divided distal to the ligature. The proximal stump was then drawn through a small magnesium tube and its margins turned down and fixed over the end of the tube. The intima of the vein was then sutured to the peritoneum.

**Sacral Anesthesia in Surgery.**—SUCHY (*Deutsch. Zeitsch. f. Chir.*, 1913, cxxv, 1) reports the results of his studies of sacral anesthesia. He says that a new era of sacral anesthesia was inaugurated when Laewen substituted the bicarbonate for the chloride of novokain and obtained a considerably increased effect. His clinical material consisted in 172 cases from Tavel's clinic. Veronal with morphine-scopolamine were employed to obtain preliminary sleep, and proved to be a very serviceable combination. He discusses, among the various phases of the subject, the solutions employed, the technique of its introduction into the sacral canal, and its effects. Of the 172 operations, the anesthesia was a complete success in 106 (61.6 per cent.). In 19 cases (11 per cent.) it was incomplete. These patients complained of mild but bearable pain, so that inhalation anesthesia was dispensed with. In 32 cases (24.3 per cent.), general anesthesia was necessary because of the severity of the pain. In the remaining 15 cases (8.7 per cent.) the sacral anesthesia was a failure. In the main, the women bore the anesthesia better than the men. The associated and after-effects were only transitory, and no persistent troubles were observed. The one fatal termination occurred in the afternoon of the day of operation, from collapse. The autopsy showed the cause of death to be internal hemorrhage, for which the method of anesthesia could not be responsible. The associated symptoms and later disturbances may in the future be reduced to a minimum when a choice of cases is more properly made. Alcoholics with nervous conditions like epilepsy, or with nervous exhaustion, should be excluded. The unequal results will also be improved when the variations in the height of the pelvis are better known and thus cases unsuitable for sacral anesthesia are excluded. These include cases in which the anatomical relations of the sacral canal are such that the trochar is introduced with difficulty and the injection requires strong pressure. The anesthetic fluid employed is a 1 to 1.33 per cent. novokain bicarbonate or phosphate solution with the addition of adrenalin in doses of 40 to 100 c.c. The effect varies in its onset, extent, duration, and intensity. On the average it begins in from eight to ten minutes, and lasts about one to two hours.

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**Permanent Drainage of Ascites into the Subcutaneous Tissue.**—PERINOFF (*Archiv. gén. d. Chir.*, 1913, vii, 1281) discusses the various methods of surgical treatment for ascites. He reports 2 cases in which he employed the method of Mauclaire, substituting a silver for a rubber tube. A large semicircular flap was made on the right side of the abdomen, its summit extending inward to the space between the umbilicus and xyphoid cartilage and including the tissues to the aponeurosis. At its base the peritoneum was exposed by a longitudinal incision. A large quantity of fluid escaped. The liver was large and compact and its surface irregular. The omentum was applied at the upper angle of the wound (Talma operation). In the inferior angle a silver tube was introduced into the cavity of the abdomen. This end was shaped like an ordinary catheter, blunt at the extremity with two lateral openings. The other end of the tube was divided into two parts, one curved to each side, which were placed upon the upper surface of the aponeurosis and fixed there by sutures.

The flap was then placed in position and sutured. Primary healing resulted and the sutures were removed in ten days, when a considerable quantity of fluid could be detected under the flap. In the first case before operation the circumference of the abdomen was 112 cm., and there was considerable asthma. In the last ten days of the twenty-nine days in the hospital after operation, the circumference of the abdomen varied between 95 and 98 cm., and the asthma had disappeared. In the second case before operation the circumference of the abdomen was 106 cm., and a month after operation it was 86 cm. The general condition of both patients was much improved by the operation. Perinoff concludes that the Drummond-Talma operation imitates nature by forming a supplementary circle of circulation. Unfortunately the beneficial results of this operation are not manifested immediately and the patient often perishes before they can do so. Permanent drainage into the subcutaneous tissue should be added to give an immediate effect. When the supplementary circulation is formed the drainage can be done away because it then becomes useless.

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**Cholera and Typhus Gangrene, Symmetrical Gangrene in the Balkan War without Danger from Frost.**—WELCKER (*Zentralbl. f. Chir.*, 1913, xl, 1625) saw 115 cases of the above type of gangrene among the Bulgarian soldiers. Almost without exception, seven to fourteen days before the development of the gangrene, the patients had passed through an attack of cholera, or had suffered from dysentery or diarrhea (80 per cent. had cholera and 20 per cent. dysentery or diarrhea). These conditions did not precede the gangrene in 14 cases. The gangrene began during convalescence or somewhat earlier, generally two to three weeks after the beginning of the typhus. With rare exceptions, the cause of the gangrene can be found in some disease, and when this fails it is probable that the history is faulty. Welcker does not agree with Wieting and others that cold and wet are important factors in the causation of the gangrene. Wieting studied the same cases on the Turkish side in the same war. After the cholera had been suppressed by the Bulgarians and only rare cases developed, the characteristics of the cholera gangrene disappeared and only the typhus gangrene remained.

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## THERAPEUTICS

UNDER THE CHARGE OF

SAMUEL W. LAMBERT, M.D.,

PROFESSOR OF APPLIED THERAPEUTICS IN THE COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY, NEW YORK.

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**Progress in Antityphoid Vaccination during 1912.**—RUSSELL (*Jour. Amer. Med. Assoc.*, 1913, lxi, 666) gives some interesting tables and charts that show very well the results of antityphoid vaccination

as applied in the U. S. Army. He says that during the past four years over 200,000 persons, mostly in the military or naval services, have been immunized without any fatalities or untoward results. There have been no reports of cases indicating that the vaccination has activated latent tuberculosis or any other disease; in fact, as regards tuberculosis, there has actually been a diminution in the number of cases of all classes of tuberculosis during this period. He makes it a rule to vaccinate the healthy only, and any febrile illness, whatever its nature, automatically postpones vaccination. It is due perhaps to this precaution that there has been freedom from bad results in the use of typhoid vaccine in the army. The practice of antityphoid vaccination has been a pronounced success in the military and naval services, in hospitals, schools, institutions and in the camps of pleasure seekers and contractors; in fact, wherever in military and civil life it has been used. He feels that its more general use, especially among the young, is advisable. The fact that it occasionally fails to confer complete protection is not a valid objection to its use, but rather an indication for its repetition at intervals to be determined in the future. A practiced program is easily formulated on the following basis: No prophylactic vaccination is needed by persons living in a city or country district in which the typhoid rate is continuously low. If, however, a person, young or adult, leaves such a region for one in which the typhoid rate is high or the changes of exposure greater than at home, vaccination is indicated. It is, of course, indicated in cities or country districts with high typhoid morbidity. Revaccinations may be managed after the plan used in vaccination against smallpox, that is, in childhood, youth, and again when exposure threatens.

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**Indications for the Treatment of Pulmonary Disease by Rest and by Exercise.**—KUHN (*Beiträge zur. klin. d. Tuberculose*, 1913, xxvii, 311) believes that the lung in cases of pulmonary tuberculosis should be kept either entirely at rest or expanding actively. He says that conditions between these two extremes favor the growth of the tubercle bacilli. The lung may be kept absolutely at rest by inducing pneumothorax. The indications for this plan of treatment are extensive processes, especially those with cavity formation and in all those cases where the temperature cannot be kept normal under the usual plans of treatment. On the other hand cases which do not have fever should be treated by cautious breathing exercises so that the lung capacity may be increased. The exercise treatment is contra-indicated in the presence of large cavities, in the acute secondary infections, and in all cases with a persistent temperature. He believes that the best method for exercising the lung is the aspiration mask devised by him. He gives a number of illustrations which show the symmetrical enlargement of the chest and expansion of the lung that resulted from the systematic use of his aspiration mask. The use of the aspiration mask may be so graduated that the forced breathing is carefully regulated and under constant control.

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**The Action of Salvarsan on the Kidneys, Especially after Mercurial Administration.**—LOEWY and WECHSELMANN (*Berlin klin. Woch.*, 1913, l, 1342) relate their experiments on dogs that, according to them,

indicate that salvarsan has an injurious action upon the kidneys, especially if they are previously damaged by the administration of mercury. This injurious action was most marked upon the water-eliminating function of the kidney and in some of the dogs complete anuria followed the injection of salvarsan. Furthermore, it was found that the urine might remain free of albumin to the end, and it is therefore apparent that the albumin test is unreliable as an indication of the toxic action of salvarsan upon the kidneys. Therefore they emphasize the importance of carefully observing the water metabolism after the administration of salvarsan for therapeutic purposes. The experiments indicate further that the danger of administering salvarsan is increased when the kidneys are not previously sound or after systemic mercurial treatment. Consequently Loewy and Wechselmann warn against the practice of a combined mercury and salvarsan course of treatment.

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**Effect of Diuretic Drugs on Life of Animals with Severe Acute Nephritis.**—WALKER and DAWSON (*Arch. Int. Med.*, 1913, xii, 177) relate their experimental work as to the effect of certain diuretics upon the life of animals having acute nephritis produced by uranium nitrate. From their experiments they conclude that the diuretic drugs, theocin, caffein and potassium acetate definitely shorten the life of a rabbit having a severe acute experimental nephritis produced by uranium nitrate. Theocin and potassium acetate gave quite parallel results and were slightly more harmful than caffein. Spartein sulphate, although not nearly so detrimental as the other drugs, however, did, in some cases, shorten the animal's life. Water in large amounts is detrimental in some cases, possibly depending on the severity of the nephritis. The diuretics alone in large doses, and water alone in large doses, when given intravenously to normal animals for a reasonable length of time, do not shorten their life and probably are not toxic in themselves. They believe that diuretics are probably contra-indicated in severe acute nephritis in man, since in animals in such cases they shorten life.

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**Clinical Results with Digipan.**—WEISS (*Münch. med. Woch.*, 1913, lx, 2499) writes concerning digipan, a preparation derived from digitalis which contains digitoxin and digitalin in practically the same proportions as they are present in the plant itself, while the irritating digitonine is practically eliminated in the process of manufacture. This preparation is recommended as a very satisfactory remedy for clinical use. With relatively small doses and in a short time the desired clinical effects such as increased blood pressure, slowing of the pulse, and diuretic action are obtained. Digipan may be given by mouth, in liquid or tablet form, or injected intravenously or intramuscularly. No untoward by-effects and no evidences of cumulative action were observed after the administration of digipan.

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**The Treatment of Pneumonia with Partially Autolyzed Pneumococci.**—ROSENOW and HEKTOEN (*Jour. Amer. Med. Assoc.*, 1913, lxi, 2203) have found that when virulent pneumococci are suspended in normal salt solution the substances on which their resistance to phagocytosis

and virulence depends pass into solution. The soluble part at a certain stage of autolysis is highly toxic and has little immunizing action, while the insoluble remnants have well-marked antigenic properties and practically no toxic effects. The protective value against experimental pneumococcus infections of detoxicated pneumococci has been found to be greater than that of heat-killed pneumococci. The details of preparing the antigens or vaccines are given in the article. The injections were given subcutaneously every day in doses of 10,000,000,000 to 20,000,000,000, until the temperature reached normal. Only slight tenderness followed the injection and there was little local or general reaction noticeable. The cases treated are divided into three classes: the cases treated outside of hospital practice, the uncontrolled cases in the hospital, and those controlled by alternate untreated cases. Of 30 cases occurring in the practice of physicians outside the hospital, 3 died. Of 35 cases in the second group, 9 died, a death rate of 25 per cent. The third group comprised the greatest number treated. The type of pneumonia in this group has been the worst, comprising a considerable number of alcoholics. Every second pneumonia patient in the order admitted to the hospital during January, February, and March of 1911, 1912, and 1913 received subcutaneous injections of detoxicated pneumococci. With this exception the treatment did not vary from that of the control group. There were 294 cases for consideration in this group, 146 receiving the treatment and 148 constituting the controls. Of the control group, 56 died, a death rate of 37.8 per cent., while of the injected group 34 died, a death rate of 23.3 per cent. Rosenow and Hektoen believe that, in view of the fact that the mortality was consistently lower in the injected cases of each year, that the average time of the first injection was late (approximately the fifth day) and that the type of cases treated was of the worst kind, the conclusion that this method of treatment of pneumonia is of value seems warranted. The results obtained in the series outside of the hospital, in which the injections were begun earlier, indicate that by the early administration of the antigen better results can be secured.

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**The Results with the Rontgen Treatment of Tuberculous Cervical Adenitis.**—Feitsch (*Münch. med. Woch.*, 1913, lx, 2610) has had good results with the use of the Röntgen ray treatment in tuberculous adenitis of the cervical lymph nodes. This treatment has been used in 33 cases of whom 8 are entirely cured and 8 are much improved. The details of the technique of administering the treatment are given in the article. The length of treatment averages six months. In some of his cases the effect of the treatment was a marked reduction in the size of the lymph nodes involved, leaving a hard lump which was easily removed under local anesthesia. This, as Fritsch emphasizes, is a distinct advantage in that it obviates the necessity of operating with general anesthesia in cases with pulmonary involvement.

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**The Autoserosalvarsan Treatment of Syphilis of the Central Nervous System.**—McCaskey (*Jour. Amer. Med. Assoc.*, 1914, lxii, 187), following the technique of Swift and Ellis has given twenty intraspinal injections of neosalvarsanized serum to 7 patients with various forms

of syphilis of the central nervous system. He says that remarkable improvement resulted in some cases and believes that this method of treatment, with perfect asepsis and cautious dosage, is devoid of danger, and offers a new and entirely rational method of attack on the localized infection in cases of cerebrospinal syphilis.

## PEDIATRICS

UNDER THE CHARGE OF

LOUIS STARR, M.D., AND THOMPSON S. WESTCOTT, M.D.,

OF PHILADELPHIA.

**Addison's Disease in a Boy, with Calcification of the Adrenals.**—H. D. ROLLESTON AND E. J. BOYD (*British Jour. Child. Dis.*, 1914, xi, 105) report a case of Addison's disease in a boy, aged twelve years. A general bronzing of the skin developed gradually. It was especially marked around the nipples, the umbilicus, and pudenda. There were a number of pigmented scars on the body but no buccal pigmentation. The boy developed synchronously loss of energy, drowsiness, a cough at night and nocturnal enuresis. An uncle and a brother are said to have had tuberculosis. There were no signs of pulmonary or spinal tuberculosis and von Pirquet's reaction was negative on two occasions. The spleen and liver were not palpable. There was no valvular disease of the heart nor any dulness behind the sternum. The skiagraph showed calcification in the adrenal glands and discrete and dense opacities at the hila of the lungs suggesting calcified nodules. The red-cell count was high, 6,492,000, and there was a high lymphocyte count supposed to be indicative of lymphatism, and a bad prognosis. The eosinophiles were high, from 5 to 7 per cent. The size of the heart was small.

**The Child in the Tuberculous Milieu.**—MAURICE FISLABERG (*Archiv. Pediatrics*, xxxi, 96) details a study of all the children of tuberculous applicants for relief to the United Hebrew Charities in New York City during three months. The social and hygienic condition of these children was investigated and all the children under fifteen years of age were examined medically and the cutaneous tuberculin test applied. The children were re-examined in four months and the tuberculin test again applied where the first was negative. There was at least one tuberculous member in each of the 217 families investigated. The hygienic conditions offered all the predisposing factors to the spread of the disease—poverty, congestion, lack of fresh air and sunshine, underfeeding, and an abundance of tuberculous sputum near at hand. Of the 692 children aged under fifteen years, 92 per cent. were exclusively breast fed. However, it seems that as long as the child remains in the tuberculous milieu it is immaterial whether it is breast fed or not, as it is bound to become infected either way.

These children were found short of weight as compared with children of non-tuberculous parents. Enlarged thoracic veins seem to be a fair sign of compression of the main trunks by enlarged glands or adherent pleura. Among the 692 children 67 per cent. had swollen cervical glands. These were for the most part non-tubercular. Enlarged tonsils and adenoids were found in 58.6 per cent. Fislaberg agrees with Simon that these hyperplasias have nothing in common with scrofula and tuberculosis. The external stigmata of tuberculosis such as tuberculides, phlyctenula, etc., were exceedingly rare in this series. The tuberculin test was applied to all the children, using crude or concentrated tuberculin and the von Pirquet method. Of the 692 children, 465, or 67.25 per cent. gave a positive reaction. The proportion of positive reactions during the first year was 15 per cent., at two years, 55 per cent., increasing steadily to 74.5 per cent. during the eleventh to the fourteenth year, and reached 83.79 per cent., counting the 37 children at fourteen years alone. Of the 692 cases, 65 showed symptoms and signs of active tuberculosis.

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**Etiology of Intestinal Catarrh in Infants.**—Karl Baerthlein and Walter Huwald (*Deutsch. med. Woch.*, 1914, xl, 418) investigated the flora of the intestinal tract in infants to determine the type of bacteria present in health and in diseased conditions of the bowel. The three classes of cases examined were (1) infants with intestinal diseases only; (2) as controls, infants with pneumonia, meningitis, hydrocephalus, syphilis, and diphtheria; and (3) 100 healthy infants. The average age was from a few days to one year. The cultures were made from material taken from the bowel by means of sterile glass tubes. The investigation was made during the summer and continued to December. Out of 72 cases of primary intestinal affections, 21 showed bacteria belonging to the dysentery group, 7 showed paratyphoid-B bacilli, and 12 showed the Bacillus pyocyaneus. Among the 72 cases the feces in 40, or 55.5 per cent. showed pathogenic bacteria. Among the control cases suffering from other diseases and among the healthy cases, but 1 case in a healthy child, showed bacilli of the dysentery group. The colon bacillus was found in 38.5 per cent. of the intestinal cases, 26 per cent. of those otherwise ill, and 12 per cent. of the healthy cases. Bacillus proteus was found in 21 per cent., 34 per cent., and 6 per cent. of the cases respectively. Organisms similar to the paratyphoid-B bacillus appeared in 13 per cent., 2 per cent., and 14 per cent. of the cases respectively. The 21 cases of intestinal disease showing bacilli of the dysentery group were the most severe, in their clinical symptoms, of the whole group, and 11 of the 21 died. In a number of cases the dysentery bacillus was found after death in the spleen and gall-bladder.

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**The Occurrence of Apical Tuberculosis in Children.**—Erich Shika (*Wien. klin. Woch.*, 1914, xxvii, 173) sketches first the adult type of tuberculosis which in the majority of cases begins in the apex of the lung. He recalls the insidious onset of the disease, the anorexia, gradual loss of weight and strength, the changes in the lung almost imperceptible at first, then gradually developing frankly into the physical signs of an apical tuberculosis. By a natural comparison the same

general symptoms in children are taken to mean apical tuberculosis by many physicians and faint or imagined changes in the percussion note or breath sounds at the apices in a child with pallor, anorexia, and poorly nourished body, are sufficient evidences to make a diagnosis of apical tuberculosis. But since the Röntgen ray has been utilized in the diagnosis of pulmonary conditions the difference between the diagnosis, clinically made and the actual condition in the lung, has become manifest, and it has been shown that most of the diagnoses of apical tuberculosis are wrong. Shika here differentiates between the apex of the lung and the upper lobe, which latter may be the seat of a tubercular process. But upper lobe tuberculosis is not a beginning condition in children, it is a terminal condition, almost always associated with the severe constitutional symptoms of a "tuberculously old" child. In six years of *x*-ray work devoted exclusively to children, Shika has found but three cases of apical tuberculosis. These were all in older children of twelve or thirteen years. Errors of diagnosis usually came under two groups: (1) cases in which the *x*-ray showed normal lungs and normal skeletal development of the thorax; (2) cases which showed changes in the lung or the thorax or in both. The majority of Shika's cases of wrong diagnosis fall in the first group, showing normal lungs and thorax. The type of child in which most frequently the erroneous diagnosis of apical tuberculosis is made, is that in which occurs rapid growth in length, slow growth in width, poor muscular development generally, thereby giving to the thorax the long and narrow appearance which is identified in the adult as the *habitus phthisicus*. The pallor in this type of child is a pseudo-anemia and due to abnormal blood distribution. The irritability of the nervous system is characteristic and the physical resistance is naturally poor. Bronchial catarrh is frequent, and the elevation of temperature in the evening so often seen is really due to muscular or nervous fatigue. On all these signs the erroneous diagnosis is most frequently made, while the *x*-ray shows almost always that the lungs are sound.

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**Epidemic of Dysentery in Little Children.**—E. KEUPER (*Münch. med. Woch.*, 1914, lxi, 474) discusses dysentery in general and reports an epidemic of this disease. Epidemics of dysentery in adults have been frequently reported in which the organism was of the so-called Y-type and of the Flexner type, grouped under the term Bacillus pseudodysentericus. Pseudodysentery is less severe than the real dysentery, and often occurs sporadically. There have been very few epidemics of this disease reported as occurring in children. A number of investigators have only found the pseudodysenteric bacillus in those cases in which the stools showed pus and blood. Keuper reports an epidemic of 20 cases in children from a few months to five years old. The usual severe symptoms of rapid loss of weight, frequent stools containing mucous and blood and great prostration prevailed. All showed a trace of albumin and cylindroids. Six of the children died, 4 of them being under ten months old, and succumbing to hyperpyrexia and convulsions. One case died of an intercurrent pneumonia, and one case, aged five years, died from sarcoma. The Bacillus pseudodysentericus was found in the greater majority of cases. The incubation

period was not more than five or six days. Out of the 6 deaths, 2 showed at postmortem no pathological changes in the intestinal tract. The other form showed anatomically only a relatively mild follicular enteritis, which would indicate that this disease is almost always a dysentery. After convalescence two negative tests of the feces are not sufficient to prove the cases non-infectious, as the bacilli may remain in the bowel for months, and rigid isolation for a long time is often necessary. Relapse occurred in 5 of the 20 cases, and lasted from two to six days. In 2 of these relapsed cases and in 2 other cases, the bacillus was found in the stools two months after the illness.

## OBSTETRICS

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

**Thrombosis and Embolism in the Puerperal Period.**—JUNGE (*Archiv f. Gynäkologie*, 1912, Band xcvi, Heft 2) contributes an interesting paper upon this subject and has collected an extensive series of statistics. His study of the subject leads him to believe that alterations or injuries to the endothelium of the bloodvessels producing interruption of the circulation is the most important factor in causing thrombosis. Such lesions are present in 26 per cent. of all labors, but do not develop sufficient severity to cause the complications in question. Multiparæ at middle life are most apt to have this lesion, and it occurs in them in 71 per cent. Puerperal thrombosis in some form develops in 74 per cent. of multiparæ, and of these 72 per cent. are cases of varices. In the first days of the puerperal period the saphenous vein is most often affected; in the latter portion of the puerperal period the femoral; and in the midportion of the puerperal period the pelvic veins. The lesion is bilateral very frequently, but when the saphenous vein is affected it is usually upon the right side, the femoral vein upon the left. This accident happens after obstetric operations, hemorrhage, infection, systemic disease, and prolonged labor, and especially in multiparæ who have varicose veins before labor. One attack predisposes to a second. The process begins with very slight elevation of temperature. The highest fever is seen when the femoral vein is involved, but no premonitory symptom can be definitely recognized. Thrombosis of the saphenous vein gives a good prognosis, while the same complication in the deeper veins is much more serious, as it predisposes to pulmonary embolism. He reports 81 cases from Fehling's clinic in Strassburg, and gives condensed histories of 22 of especial severity. Fortunately, embolism is comparatively rare, for in the records of 10,056 labors in the Strassburg clinic there were 81 cases of thrombosis, and but 4 cases of embolism—0.04 per cent.—with but one fatal issue.

When the records of other clinics are compared in 16,000 labors in the Dresden clinic there were 20 cases of embolism, or 0.0125, with 14 fatalities. This is the largest number in his collection of statistics, other clinics giving an average closely resembling the Strassburg clinic.

DUFFEK (*Archiv f. Gynäkologie*, 1912, Band xcvi, Heft 2) contributes a paper upon septic thrombosis, reporting a series of experiments upon animals. He finds that in the human subject septic thrombi show a peculiar formation resembling coral, which readily produces detached masses forming emboli. These are composed of leukocytes and layers of fibrin and contain bacteria, while the permanent masses are not so rich in germs. The formation of a thrombus and the localization of bacteria indicate that the activity of the bacteria has become limited to the local lesion. Under normal conditions the uterine veins at the placental site very rarely form detached masses. In puerperal infection these thrombi become infected and later become separated. Where the uterus is in a tonic condition and is not in active contraction, whether in pregnancy or the puerperal period, the separation of thrombi from their original site rarely occurs. The question as to whether there is a premonitory symptom of thrombosis and embolism has occasioned considerable discussion.

KÜSTER (*Zentralblatt f. Gynäkologie*, 1911, No. 30) has maintained that there is no premonitory alteration of pulse and temperature in cases of thrombosis or embolism.

MICHAELIS (*Zeitschrift f. Geburtshülfe und Gynäkologie*, 1912, Band lxx, Heft 1), maintains his original contention that the pulse and temperature are always altered before thrombosis and embolism occur. In this connection it may be well to recall Maehler's sign, that the pulse rises out of proportion to the temperature, the temperature often falling after a preliminary rise, while the frequency of the pulse steadily increases. The effort to lessen puerperal mortality is a constant one and meets with varying success.

In view of the recent discussion upon midwives in America, Grünbaum's paper (*Zentralblatt f. Gynäkologie*, 1912, No. 35) is of interest. He believes that midwives should conduct cases of labor without internal examinations. In 1000 confinements, 741 were conducted without an internal examination, while 259 were examined. This would indicate that 75 per cent, of cases do not require internal examination. It is usually thought that the omission of examination is dangerous because abnormal presentations and prolapse of the cord will not receive early recognition. In the 1000 labors there were 5 transverse positions which were recognized by external examination only. There were 7 cases of prolapse of the cord, in 3 of which the patient was brought into the clinic with the cord pulseless. In the remaining 4 diagnosis was made easy three times sufficiently early to save the child. In but one case could omission of internal examination be blamed for the loss of the infant. When one comes to study the influence of internal examination upon morbidity, it is found that among those not examined the general morbidity was 2.1 per cent., and of these but 0.6 per cent. were from puerperal causes. Among those examined the morbidity was 6.6 per cent. The general mortality of this entire series of cases was 0.3 per cent., and there was no death from puerperal septic infection. Among these patients 95 were operated

upon, of whom but 5 had a moderate elevation of temperature. This occurred among 37 forceps cases and 14 versions. In 3 transperitoneal Cesarean sections, one had abscess in the abdominal wall.

## GYNECOLOGY

UNDER THE CHARGE OF

JOHN G. CLARK, M.D.,

PROFESSOR OF GYNECOLOGY IN THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA.

**New Operation for Rectal Prolapse.**—SIPPEL (*Zentralbl. f. Gyn.*, 1914, xxxviii, 297) describes an operative procedure which he devised for the treatment of a rectal prolapse in a patient aged sixty-eight years. The prolapsed portion of the rectum formed a mass outside the anus, about the size of a small fist, and was composed entirely of the pelvic portion of the rectum and lower end of the sigmoid, the anal portion of the rectum for a distance of about 3 cm. above the sphincter remaining in place, the pelvic portion prolapsing through this and through the sphincter. The perineum was somewhat relaxed, but the uterus was forward, in good position, and showed no tendency to come down. The first step in the operation was to make a longitudinal incision through the entire posterior wall of the vagina and cervix, exposing the anterior wall of the rectum from the sphincter to the reflection of the peritoneum at the bottom of Douglas' pouch. The peritoneum was pushed upward somewhat, and the lateral flaps of the posterior vaginal wall, with the underlying tissue, were dissected well back on each side, so as to give a good exposure of the greatly distended and relaxed anterior wall of the rectum. This was then infolded in a longitudinal direction by transversely placed sutures, the process being repeated four or five times, until practically the whole anterior wall was folded into the lumen in the form of a thick, longitudinal ridge, the diameter of the rectum being reduced by this means about to normal size. The upper portion of the rectum was then firmly sutured to the posterior surface of the cervix, these sutures serving at the same time to close the incision in the latter. An anterior colporrhaphy was performed; the redundant portions of the flaps of the posterior vaginal wall were cut away, and the edges brought together with deeply placed sutures, which included in their bite a portion of the rectal wall. The separated levator fibers were then brought together, the rectal wall being included in these sutures also. The operation was concluded by a plication of the sphincter, which was quite markedly relaxed. In this manner, the portion of the rectum which showed a tendency to prolapse was firmly anchored to the cervix, the posterior vaginal wall, and the levator ani. The wounds healed well, and the patient shows after six months every appearance of being permanently cured. Sippel suggests that in similar cases, in which, however, there is some tendency to prolapse of the uterus, a firm ventrofixation of this organ to the anterior abdominal wall might be necessary in addition.

**Bacteriology of Leucorrheal Discharges.**—A praiseworthy attempt has been made by CURTIS (*Surg., Gyn., and Obst.*, 1914, xviii, 299) to throw some light on a subject upon which we possess very little definite knowledge—the bacterial flora of the lower female genital tract under normal and pathological conditions and the relation of bacteria to the production of leucorrhea. Although the paper represents merely a preliminary study, which has not as yet led to definite results, several points are presented of considerable interest. As a result of his studies, Curtis has come to the rather surprising conclusion that purulent discharges rarely come from the uterus or cervix, arising practically in all cases in the lower genital tract, since in a number of instances cultures taken from the endometrium and cervix failed to show the presence of any bacteria. The typical discharge for which, in his opinion, the cervix is responsible is mucus, which forms in the vagina an excellent culture media for any organism which may come in contact with it. In all, 75 patients were studied, 35 of these suffering from a profuse leucorrhea. The material for culture was taken from various portions of the vagina, chiefly the vicinity of the cervix, and was inoculated on blood-agar, blood-ascites-agar, and other media, and grown under aërobic and anaërobic conditions. Fresh smears were also examined, and were found to contain a preponderance of the large, Gram-positive "vaginal bacilli" of Döderlein; in normal cases these being practically the only organisms present. In purulent discharges, however, there are always enormous numbers of other varieties of organisms, among which Gram-negative bacilli tend to predominate. By far the greater number of organisms present in such discharges are anaërobic in nature. In cultures made from the vulvar region, however, the relative number of aërobes is much greater than in those from the upper portions of the vagina, the chief organisms in the former region being B. coli, staphylococci, and pseudodiphtheria bacilli. Several animals were injected with washings and fresh material from the four worst cases of leucorrhea in the series, without any distinct evidence of toxicity being discovered. A considerable number of bacilli and cocci, showing various cultural characteristics, were isolated, but most of these have not been definitely identified. Streptococci were almost never found in fresh preparations, but were seen to develop from diplococci on artificial media. They cannot, therefore, be considered of any considerable importance in the production of leucorrhea, nor can the colon bacillus; while the preponderating role is apparently played by the anaërobic group, the gonococcus is, of course, by far the most important single organism. In a surprisingly large number of cases, however, this eventually disappears so completely that it is not demonstrable by any method at our command, which suggests that perhaps the chief role played by it is in preparing the soil for the leucorrhea-producing anaërobes. Curtis states that apparently some practical results from this work will be obtained, in the form of vaccine therapy, but that he is not prepared to report upon this phase of the subject as yet.

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**Regeneration of Endometrium after Curettage.**—Some interesting histological studies of the exact manner in which the endometrium regenerates after the uterus has been curetted have been undertaken

by RICHTER (*Gyn. Rundschau*, 1914, viii, 47). He performed a curettement at varying periods before operation upon a number of uteri, whose removal was necessary on account of some condition, such as chronic adnexal disease, which did not greatly affect the endometrium, and also carried out a series of experiments upon dogs. He found that by the end of the first twenty-four hours the fresh wound caused by the curette is covered with a layer of fibrin and polymorphonuclear leukocytes, an expression of an inflammatory reaction to the injury on the part of the tissue. During the next twenty-four hours the picture remains practically the same, except that the leukocytes increase in number. After the third day, however, the picture varies somewhat according to whether the traumatism has been deep or superficial. In the deeper wound areas young bloodvessels, accompanied by leukocytes and fibroblasts, begin to grow into the fibrin layer, the fibroblasts apparently arising not from the remnants of old endometrium, but from the connective tissue which lies between the muscle fibers of the uterine wall. The epithelial covering, however, is supplied always by a gradual extension over the surface of the newly formed connective tissue of cells from some neighboring island of preserved mucosa, or from the fundus of a gland that has escaped destruction, the epithelial covering being practically complete by the ninth day. Gradually a fibrous intercellular substance is formed, especially in the deeper portions of the new endometrium, the superficial layers remaining more distinctly cellular. Up to as long as the twenty-sixth day, however (beyond which the investigations did not go), this tissue is wholly without glands, the only indications of these being a few shallow depressions in the surface epithelium, from which it is possible, but not definitely demonstrated, that new glands may be developed by ingrowth. Such development would therefore be centripetal in direction; it certainly takes place slowly, if at all. The more superficial wounds, on the other hand, are covered in large areas by epithelium as early as the third day, and by the fifth the process of epithelialization is complete. The stroma formation is analogous to that seen in the deep wounds, but gland regeneration occurs certainly in a centrifugal direction, from undestroyed ends of glands lying between the muscle fibers. This process is fairly rapid, for in these areas the gland regeneration is practically complete by the fifth day. In deep wounds, where some of the muscle tissue is removed, as often occurs when curettage is vigorously performed, this appears never to regenerate, but to be replaced by connective tissue.

## OTOLOGY

UNDER THE CHARGE OF

CLARENCE J. BLAKE, M.D.,

EMERITUS PROFESSOR OF OTOLOGY IN THE HARVARD MEDICAL SCHOOL, BOSTON.

**Examination into the Hearing Power, Comparatively, of Blind Persons and Persons with Average Normal Vision.**—HORTER

(*Passow's Beiträge*, 1913, vi) made tests as to the audible duration of the tuning forks in the Bezold-Edelmann series in the two classes of cases the result proving that the blind have no special compensatory accentuation of the sense of hearing and that improvement in the hearing proper does not accrue with duration of the loss of sight; in other words, that there is no evidence of educative improvement of the function itself. On the other hand, the blind appear to listen and to hear more concentratedly than do seeing persons and are less disturbed in their effort at hearing by surrounding, concomitant, conditions. From Horter's observations it would seem to be evident that while the actual hearing power is not augmented in the blind it is a far more effective means of determination of the direction of a sound source and of its progress in motion, constituting, therefore, for the blind, the most important sense for a determination of the relationship of the environment; this is true not only of rythmic recognizable sounds but of the incoördinated sounds constituting noise. Under these circumstances it is the duty of the medical profession and of the schools both to take measures to conserve and to educate a sense which is of so much importance to the ambulant ability of the blind, it being made a stated part of the curriculum of the blind to train the exercise of the hearing power for purpose of orientation and also to compensate for the possible want of acute hearing by education in acuity of attention and of observation.

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**Otitic Migraine.**—MARGULIES (*Präger med. Woch.*, 1913, No. 27) reports 4 cases of migraine with vertiginous attacks during which there was a general, and considerable, depreciation in the hearing, this depreciation lessening with recovery from the vertigo and the hearing being normal in the period between attacks. The explanation of Barany as to the conjectural cause of the symptom complex which bears his name is not accepted by Margulies as applicable to the cases which he has observed and made the subject of his paper; in his opinion the cause was neither adhesions nor cyst formation but merely an increased exudate due to some irritation which subsided and decreased as the irritation decreased, with a corresponding disappearance of the symptoms, the point of attack being presumably labyrinthine. In all probability the labyrinth and vestibular apparatus play a larger role than has heretofore been supposed in the causation of migraine, and although labyrinthine symptoms such as are evidenced in these reported cases are rare the frequent observance of hyperesthesia acustica as an accompaniment of migraine may be justifiably taken as concurrent evidence.

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**Primary and Secondary Suture in Mastoid Operations.**—WALB (*Zeitschr. f. Ohrenheilkunde*, 1913, lxviii) recommends preferentially the primary suture, as he has practised it for twenty years both in the typical mastoidectomy and in the radical operation, leaving the lower end of the wound free and open, without even a gauze drainage wick and removing the subcutaneous continuous wire suture at the end of eight days. In only a small percentage of the cases was the wound left open, unsutured, and then in deference to the presence of an uncovered and possibly not normal sinus or the complication of an extradural abscess when it was desirable to keep the wound cavity

open for inspection. Even in these cases, if the suppurative process had terminated and the wound had become aseptic eight days or more after the operation he made a secondary suture in the same manner as that primarily practised. The tamponage used in the non-sutured cases was not too firmly pressed and was more lightly made as the cases progressed toward recovery.

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**Aural Diagnosis of Constitutional Syphilis.**—Beck (*Münch. med. Woch.*, No. 50, 2778) was able to demonstrate, in a considerable number of cases of syphilis with normal hearing, and in other cases of the same class in which there had never been indication of aural disturbance, a marked depreciation of the hearing by bone conduction this symptom being present in 80 per cent. of the syphilitics examined and tested for hearing by bone conduction. Similar clinical observations and tests having been heretofore made, with like results, in instances of intracranial processes accompanied by encroachment upon the lumen of the cranial cavity, brain tumors for instance, in other cases also in which there was no indications of aural participation and in cases of hydrocephalus, all accompanied by a considerable degree of intracranial pressure, it seemed possible that the occurrence of this symptom is syphilis might be explained in the same manner. In order to arrive at a definite conclusion lumbar puncture was done in a series of luetic cases exhibiting the symptom of decreased duration of hearing by bone conduction. A repetition of the tests a few hours after the lumbar puncture showed that the symptom had disappeared, to return, however, in from two to three days. The relationship between increased intracranial pressure and the shortening of duration of hearing by bone conduction was confirmed by the examination of patients with only the initial symptoms of sclerosis, negative Wassermann, and absence of localized swelling of the lymphatics. In the primary stage this symptom was, with very few exceptions, absent, it was most frequent in those cases in which the infection had become constitutional and the general systemic evidences appeared. As the result of these observations Beck is of the opinion that in the case of an otherwise apparently healthy patient without other aural symptoms but with a definitely decreased duration of hearing by bone conduction the question of a possible luetic cause should be considered.

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**Facial Paralysis in Fractures of the Petrous Process of the Temporal Bone.**—De Stella (*Archiv. Internat.*, xxxv, 3), in the cases of fracture of the base of the skull and of the petrous bone, found that two types were distinguishable. The first and less frequent occurred at the moment of the injury and resulted from an implication of the bony wall of the nerviduct of the facial to such an extent as to directly wound the nerve or to result in its compression by hemorrhagic exudate. Recovery was established, unless the nerve had been actually divided, in from six to twelve weeks. In the second more usual type the paralysis appeared not immediately but from two to four days after the injury, originating presumably in a secondary compression of the nerve as the result of an inflammatory exudate about and within the nerve, a condition almost inevitably incident to a basal fracture either with or without extension to the nerviduct of the facial. The duration of the

paralysis, to the time of recovery is, in this class of cases, usually short. In the case of the first type mentioned there was an interesting complication in a concurrent paralysis of the abducens resulting from pressure exercised by a hemorrhage at the apex of the petrous bone in the line of the fracture.

## PATHOLOGY AND BACTERIOLOGY

UNDER THE CHARGE OF

JOHN McCRAE, M.D., M.R.C.P.,

LECTURER ON PATHOLOGY AND CLINICAL MEDICINE, MC GILL UNIVERSITY, MONTREAL; SOME TIME PROFESSOR OF PATHOLOGY IN THE UNIVERSITY OF VERMONT, BURLINGTON, VERMONT; SENIOR ASSISTANT PHYSICIAN, ROYAL VICTORIA HOSPITAL, MONTREAL.

**The Resistance of the Intestines to Gastric Digestion.**—MARIE and VILLANDRE (*Jour. de Physiol. et de Path. générale*, May 15, 1913, xv, No. 3) have continued their experiments bearing upon whether or not intestine in contact with gastric juices is digested. The open jejunal loop with its mucosa exposed was found by them, to remain for months without any trace of digestion, if its blood supply were not damaged. The close jejunal loop had equally good fortune under the same circumstances, and Marie and Villandre consider that interference with the vascular supply is the essential feature of this type of necrosis. They think further that the greatest enemy to proper blood supply is not muscular contraction, but rather the way in which sutures are placed, especially considering that there is danger to the graft by infection through the bacteria in the stomach contents attacking the points of suture. The gastric juice is able to play only a secondary part in the disappearance of the closed loop, that is, it is able only to finish destruction already begun by a necrosis of vascular or inflammatory origin; in other words, it can digest only dead tissue. These experimental facts are entirely contrary to Katzenstein's theory of a specific antipepsin in the stomach and duodenal walls; he considered the causation of ulcers as dependent upon differences of equilibrium between the pepsin and antipepsin. The living intestine, Marie and Villandre say, if well nourished is as far removed from the danger of digestion as the stomach wall itself, and they point out that in addition the spleen, gall-bladder, and omentum, if their vitality be not too seriously injured by intervention, are equally capable of making an effective resistance to the gastric juice. Claude Bernard's theory of epithelial protection to explain the resistance of the stomach is also contradicted by Marie and Villandre's experiments in which they exposed an intestinal serosa and, again, a naked muscularis to the gastric juices; these, like the mucosa, were also able to resist. The gastric epithelium tends to cover by proliferation the foreign body, provided it has not already a mucosa. To consider the defence as due to mucus coating the surface of the foreign body, it is hardly probable that it can efficaciously cover the large grafted surfaces if these are not themselves provided with mucus-bearing cells.

**The Endotoxin of the Bacillus Typhosus.**—Barantchik (*Rousski Vratch*, xii, 289, 1913) has used Kravkoff's method of extracting from bouillon cultures of B. typhosus a substance which appears to belong to the nucleoproteins, and proves to have an extremely toxic action. Intravenous injection of the same kills the rabbit in doses of 0.02 grams per kilogram; subcutaneous or peritoneal injections are less fatal. The symptoms and pathological changes observed after an acute intoxication by this substance correspond in all particulars to those which may be observed in animals infected by the living culture. In the blood appear the specific antibodies for the bacillus, and the agglutinins, precipitins, and bacteriolysins, are similarly specific, and we must recognize in this substance a specific endotoxin which preserves all the peculiar features of the antigen of B. typhosus. Considering with this that antitoxic substances do not exist in the blood of the cured cases, or in the animals immunized by the living bacilli, Barantchik concludes that the bacillus produces no ectotoxin.

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**Effects of Anesthetics in Nephritis.**—MacNider (*Jour. Med. Research*, August, 1913, xxviii, No. 3) gives the results of his observations upon anesthetics in animals who are already the subjects of nephritis from the use of uranium. In the kidney damaged by this means the epithelial injury is greater than that of the vascular system, although both are observable, and adult and old animals are more susceptible to these changes than young animals. The use of an anesthetic increases the severity of the changes which were found, and this again proves to be of greater extent in the old than in the young. MacNider lays stress once more upon the peculiar differences which are manifested by different parts of the tubules in reaction to the irritation, the proximal parts of the tubules being least affected, while the loops of Henle showed more pronounced lesion. Contrary to what one might expect MacNider found that morphine-ether anesthetic was less toxic to animals who were the subjects of such nephritis, than the chloroform-alcohol combination.

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